AMERICAN

DYESTUFF REPORTER

Volume 47 May 19, 1958 Number 10

EFFICIENCY OF ORLON DYE-RETARDING AGENTS VS CHEMICAL STRUCTURE

SIDNEY COHEN and ABRAHAM S ENDLER

Hart Products Corp
New York, NY

The effect of changes in chemical structure of organic amino compounds on the dye-retardation efficiency of these compounds when used to retard the dyeing of Orlon acrylic fiber by cationic dyes has been investigated. Studies on compounds of known structure revealed that most water-soluble amino compounds have a retarding action and indicated the structural factors which affect retarding efficiency.

INTRODUCTION

THE dyeing of Orlon Type 42 acrylic fiber with cationic dyes requires the use of a retarding agent for production of level dyeings in light to medium shades (*1, 2*). Data showing the effect of various proprietary agents on the rate of dye exhaustion have been published, but the chemical nature of the agents used has not been disclosed.

The achievement of level dyeing has long been a problem with natural fibers as well as synthetics. Gunther (*3*) gives a bibliography on the subject. He points out that dyers commonly use methods such as starting the dyeing at a low temperature and addition of dyestuff at intervals in order to obtain level shades. However, the use of chemical agents has often been found necessary despite these devices. Some of these agents act by increasing the migration ability of the dye. Classes of compounds used for this purpose and methods of test have been described (*4, 5*).

Several authorities have pointed out that leveling agents may reduce dyeing rate by acting on the dye itself, reducing its effective concentration; or may act on the fiber, blocking the dye by a chemical barrier. Valko (*6*) showed that nonionic surfactants form large molecular aggregates with leuco-vat dyes and, in effect, compete with the fiber for the dye. With wool, anionic surfactants are adsorbed on the fiber and block the adsorption of acid dyes (*7*). Lomas (*8*) presents an extensive discussion of the theory of the action of leveling agents in wool dyeing, and includes experimental data showing that poorly leveling acid dyes are preferentially extracted from water by a layer of nonionic surfactant, while good leveling dyes are not. This indicates interaction between anionic dyes and nonionic surfactants.

In the case of Orlon Type 42 fiber as now manufactured (the more dyeable merge), the chemical structure of the polymer has not been disclosed. Of course the main component is acrylonitrile, but some means, such as copolymerization or graft polymerization, has been employed to introduce functional groups which make the fibers receptive to cationic dyes. Presumably, these functional groups are acidic, so that the fiber acts like an ion-exchange resin, adsorbing cations from solution. It has been found that various colorless cationic surfactants are adsorbed by Orlon fiber and act as retarding agents for cationic dyes in this case.

The object of this investigation was to determine the effect of variation in chemical structure on the retarding efficiency of several classes of cationic compounds.

MATERIALS TESTED[1]

A) LONG-CHAIN PRIMARY AMINES

Decylamine, $C_{10}H_{21}NH_2$, 90% C_{10} content.

Dodecylamine, $C_{12}H_{25}NH_2$, 95% C_{12} content.

Tetradecylamine, $C_{14}H_{29}NH_2$, 92% C_{14} content.

Hexadecylamine, $C_{16}H_{33}NH_2$, 92% C_{16} content.

B) LONG-CHAIN QUATERNARY AMMONIUM COMPOUNDS

Dodecyltrimethylammonium chloride, $C_{12}H_{25}N(CH_3)_3{}^+Cl^-$, 90% C_{12} content.

Coco-trimethylammonium chloride, $R_{coco}N(CH_3)_3{}^+Cl^-$. This material is derived from coconut oil and has the following approximate chain-length distribution: 47% C_{12}, 18% C_{14}, and lesser quantities of C_8, C_{10}, C_{16}, and C_{18}.

Hexadecyltrimethylammonium chloride, $C_{16}H_{33}N(CH_3)_3{}^+Cl^-$, 93% C_{16} content.

Octadecyltrimethylammonium chloride, $C_{18}H_{35}N(CH_3)_3{}^+Cl^-$, 93% C_{18} content.

"Tallow"-trimethylammonium chloride, $R_{tallow}N(CH_3)_3{}^+Cl^-$. This material is derived from tallow and has the following approximate chain-length distribution: 48% C_{18} mono-unsaturated, 16% C_{18} saturated, 27% C_{16}, and minor proportions of other chains.

Coco-trimethylammonium methosulfate, $R_{coco}N(CH_3)_3{}^+(CH_3SO_4)^-$.

Coco-dimethylethylammonium ethosulfate, $R_{coco}N(CH_3)_2(C_2H_5)^+(C_2H_5SO_4)^-$.

Coco-benzyldimethylammonium chloride, $R_{coco}N(CH_3)_2C_6H_5CH_2{}^+Cl^-$.

C) OTHER LONG-CHAIN AMINE DERIVATIVES

Carboxymethyldimethylcocoamine (coco-betaine), $R_{coco}N^+(CH_3)_2CH_2COO^-$.

Bis(hydroxyethyl)cocoamine, $R_{coco}N(CH_2CH_2OH)_2$.

Dimethylcocoamine oxide, $R_{coco}N(CH_3)_2O$.

[1] The long-chain amines and methylated amines were obtained from Armour Chemical Division. Other derivatives mentioned in the text were prepared from these materials by known methods.

EXPERIMENTAL PROCEDURE

A standard dyeing procedure was adopted, with periodic determinations of the dye exhaustion by a photocolorimetric method.

In a 300-ml stainless-steel beaker were placed 5 ml of a solution containing 1% Sevron Green B, 1% sodium acetate, and 4% acetic acid. The retarding agent was added by pipetting the desired amount of a stock solution of definite concentration, and the volume brought to 300 ml with distilled water.[2] The solution was brought to a steady boil on an electric hot plate and the volume maintained within 5 ml of the original volume by periodic additions of boiling distilled water.

Prescoured Orlon fabric, 10 g, was added and the dyeing carried out at the boil. (The prescouring was performed with a nonionic detergent and phosphate builder, followed by thorough rinsing. It was necessary to scour in order to remove oily material on the raw fabric, which interfered with obtaining consistent photometric results.)

Immediately before the addition of the Orlon, and periodically during the dyeing, approximately 10 ml of the solution was pipetted from the dyebath, filtered to remove lint, and cooled to 30° C. The optical transmittance of the sample was measured by a Leitz Industrial-Rouy Photrometer, using Filter #535. The sample was then returned to the dyebath. From a standard curve prepared from known concentrations of Sevron Green B in acetic acid-solution acetate buffer solution, the dye concentration corresponding to the transmittance reading was determined. From this value, the percent exhaustion of the dyebath was calculated and the values used to plot the curves of percent exhaustion against time.

It was found that there usually was a small drop in transmittance in the first few minutes of the dyeing. This was not investigated further except to note that a number of the retarding agents increased the transmittance of the dye solution somewhat. If these materials are adsorbed on the Orlon fiber in the early stages of dyeing, and are thus removed from solution, this would account for the initial decrease in transmittance. For the purpose of this work, the precise determination of the dyeing rate in the earliest stages is not important, and on the graphs of the data the percent exhaustion is shown as zero up to the time that the optical transmittance of the dyebath began to increase.

[2] Stock solutions of quaternary compounds were prepared in 20% isopropanol—80% water solution. Long-chain amines were dissolved in the same solvent and neutralized with a slight excess of acetic acid.

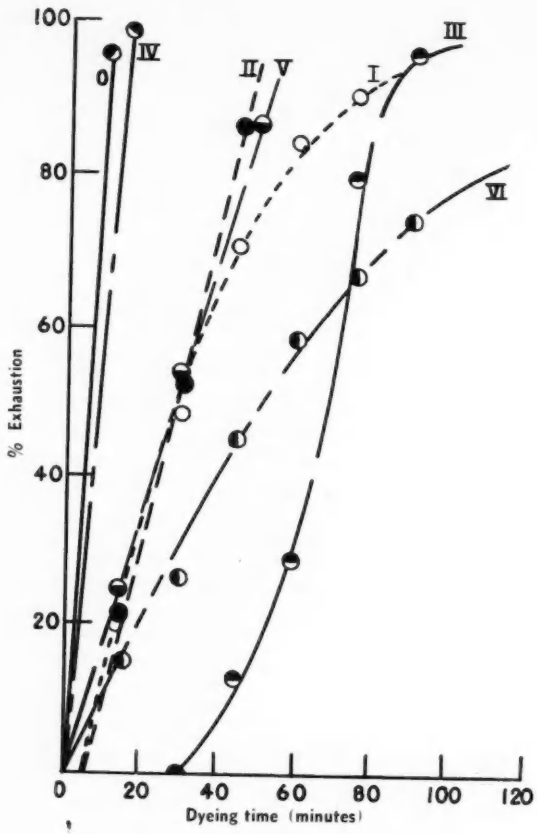


Figure 1
Effects of solubilizing group
Derivatives of coco-dimethylamine
1.5% additive

O — no retarding agent
I — coco-trimethylammonium chloride
II — coco-trimethylammonium methosulfate
III — coco-benzyldimethyl ammonium chloride
IV — coco-betaine
V — coco-dimethylamine hydrochloride
VI — dimethylcocoamine oxide

RESULTS

Fig 1 shows data obtained using various derivatives of the same amine: coco-dimethylamine. The same ratio of retarder active content to Orlon fiber, by weight, was used in each case. Methyl and ethyl quaternizing groups gave similar results, with effectiveness varying inversely with molecular weight of the quaternizing compound. Thus, dimethyl sulfate gives a less effective retarder, by weight, than does methyl chloride.

Quaternization by benzyl chloride (Curve III) produces a different type of retarding action. Initial dyeing rate is quite low, but when dyeing begins after an induction period, the rate of exhaustion is much more rapid than with the methylated quaternary.

Amine oxide (Curve VI) gives a dyeing curve similar to methyl chloride quaternization. The hydrochloride of cocodimethylamine (Curve V) also gives a similar exhaustion curve. This indicates that quaternization of the amine is not necessary for effective dye retardation. In fact, the coco betaine (Curve IV), which contains a quaternary ammonium group internally neutralized by a carboxylic acid group, is found to be completely ineffective as a retarder. The presence of hydroxyl groups on the cationic molecule also reduces the retardation effectiveness. Although not plotted on the graph, dyeing experiments using coco - dihydroxyethylamine indicate that this compound is much less effective than cocodimethylamine, although it does exhibit some retarding action.

As mentioned above, quaternization by methyl chloride and by dimethyl sulfate yields compounds with retarding effectiveness varying inversely with the molecular weight of the quaternizing compound. It is thought that the retarding action of these compounds is due completely to the long-chain amine portion of the molecule, with the anionic group (chloride, methosulfate, etc) playing little or no part. Fig 2 shows data for three derivatives of cocodimethylamine com-

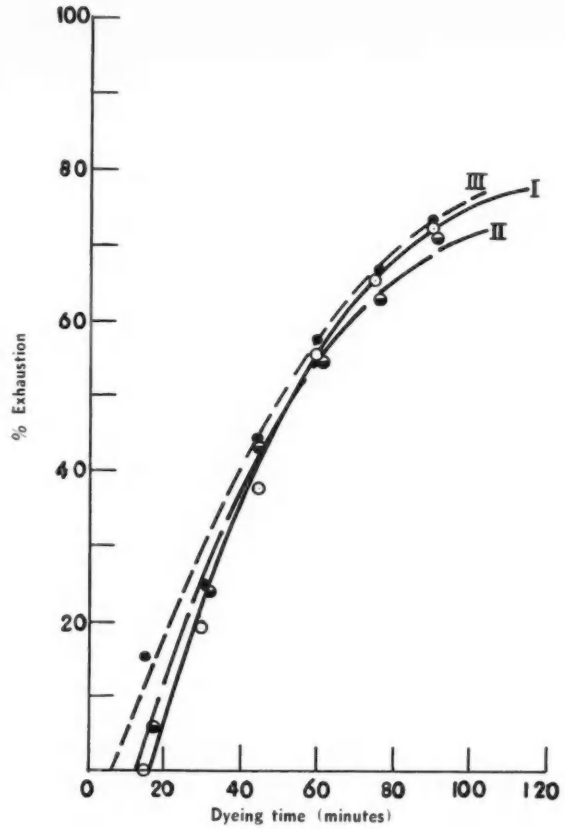


Figure 2
Effect of anion $[C_{12}H_{25}N(CH_3)_2R]^+X^-$
0.00625 Mol %

$C_{12}H_{25}$ denotes average alkyl group from coconut oil

Curve	R	X
I	CH_3	$C_2H_5SO_4$
II	C_2H_5	CH_3SO_4
III	CH_3	Cl

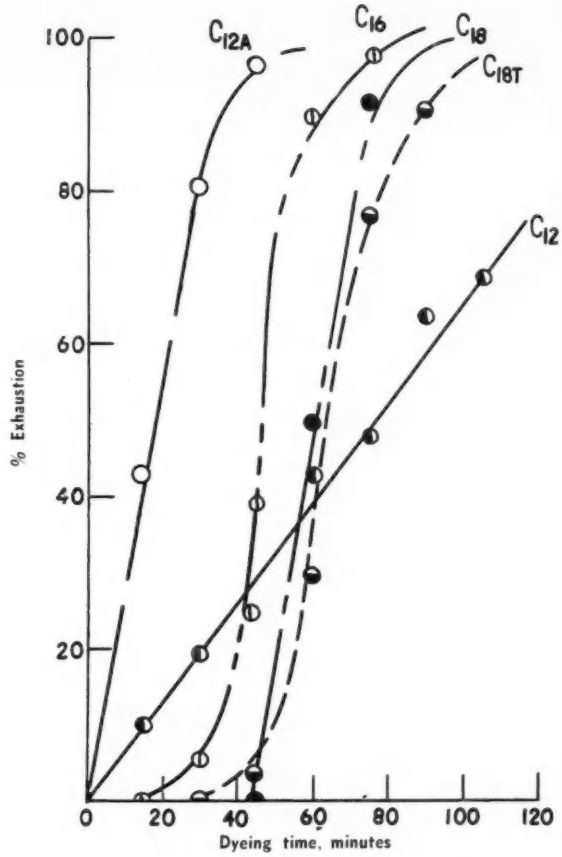


Figure 3
Effect of chain length $[RN(CH_3)_3]Cl$
0.0040 Mol %

Alkyltrimethylammonium chlorides: C_{12}, dodecyl-; $C_{12}A$, coco-; C_{16}, hexadecyl-; C_{18}, octadecyl-; $C_{18}T$, tallow

pared at the same ratio of *moles* of retarder per 100 g Orlon fiber rather than at the same weight ratio. The curves are quite close, the variations falling within the range of experimental error. Curve I shows that quaternization of this amine with diethyl sulfate is equally as effective as quaternization with dimethyl sulfate on a molar basis.

The effect of carbon-chain length on retarding action is shown in Fig 3 for quaternary compounds of the alkyltrimethylammonium chloride type. The retarding action is seen to depend not on the average chain length of the compound but on the proportion of the particular compounds present. The C_{16} and C_{18} compounds show an induction period of very low dyeing rate, followed by a high rate of exhaustion after dyeing begins. The 90% C_{12} quaternary shows a steady retarding action and a much lower dyeing rate than the other compounds. The coco amine quaternary, which has an average chain length about C_{12}, but actually contains less than 50% of the C_{12} compound, gives a somewhat lower dyeing rate than the C_{16} and C_{18} compounds, but without the induction period. Despite the average chain length of C_{12}, the coco amine quaternary is much less effective than the 90% C_{12} compound.

Unsaturation in the carbon chain has little effect, as indicated by the close similarity of the curves for the "tallow"-trimethylammonium chloride and the saturated C_{18} compound.

Fig 4 gives similar data showing the effect of chain length in a series of primary alkyl amine acetates. There is a progressive increase in induction period and a progressive decrease in dyeing rate with increase of chain length from C_{10} to C_{16}. The curves level off and appear to reach equilibrium exhaustion levels varying inversely with chain length.

The amount of change in the retardation with change of the molar concentration of retarder on the weight of fiber depends upon the chemical type. Fig 5 shows data at three molar concentrations for both the C_{16} primary amine and for coco - trimethylammonium chloride. Although the retardation effect varies directly with retarder concentration in both cases, the data shows that the variation is much greater in the case of the C_{16} primary amine.

DISCUSSION

The results indicate that any long-chain amino compound is likely to have a retarding effect in the dyeing of Orlon with cationic dyes. Preference for quaternary ammonium compounds is not justified on the basis of the retardation effectiveness alone. Other reasons, such as superior solubility at higher pH values, resistance to discoloration, etc, which were not evaluated in this work, probably make quaternaries preferable to other types of amino compounds for commercial use.

The optimum chain length for alkyl-

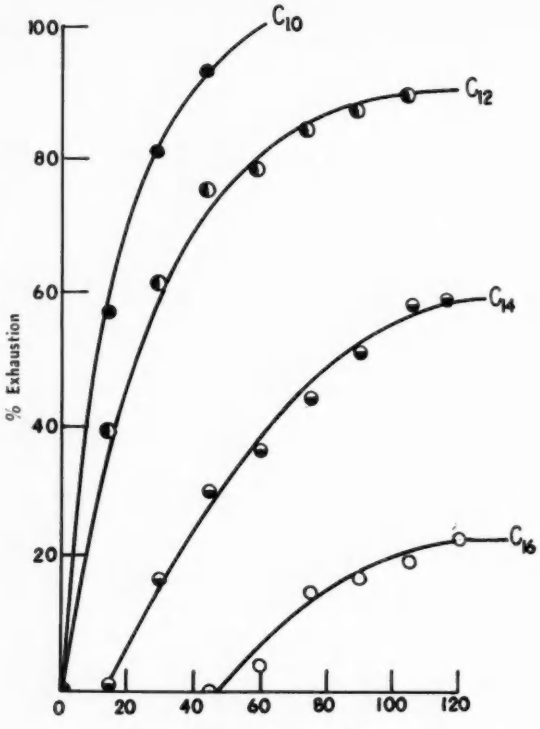


Figure 4

Effect of chain length ($RNH_2.CH_3COOH$) 0.00625 Mol %

Alkylammonium acetates: C_{10}, decyl-, C_{12}, dodecyl-; C_{14}, tetradecyl-; C_{16}, hexadecyl

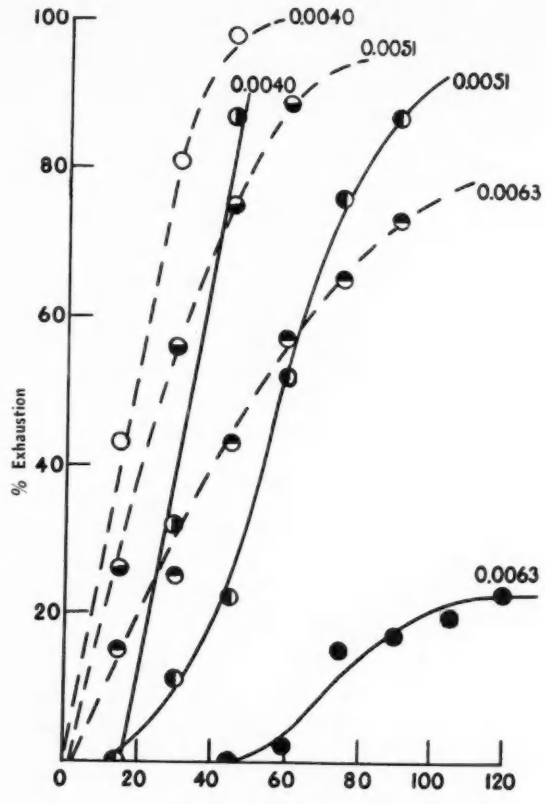


Figure 5

Effect of concentration

- - - - coco-trimethylammonium chloride;
———hexadecylammonium acetate.
Concentrations noted are in moles per 100 g fiber.

trimethylammonium salts appears to be about C_{12}, which gives a steady dyeing rate up to fairly high exhaustion levels. In practice, however, the C_{16} or C_{18} type might be preferable, since the induction period in the dyeing prevents uneven strike of the dye, while a high level of exhaustion is reached more quickly than with the C_{12} compound.

Only the dye Sevron Green B was used in this investigation, but results in commercial practice indicate that the relative effectiveness of various retarders will be similar with other cationic dyes. It is to be expected, of course, that the amount of retarder needed to obtain a particular rate of dyeing will vary with the dye used.

In comparing the retardation effectiveness of different agents, tests should be performed at several ratios of retarder to Orlon fiber since the results show that change of retarding action with concentration of retarder varies markedly among different chemical types of retarding agents.

TRADEMARKS

Orlon and Sevron are trademarks of E I duPont de Nemours & Co, Inc.

LITERATURE CITED

(1) Clarke, R A, and Bidgood, Jr, L: *Am Dyestuff Reptr* **44**, P631 (1955).

(2) Neary, J P, and Thomas, R J: *ibid* **46**, P625 (1957).

(3) Gunther, D H: *ibid* **38**, P236 (1949).

(4) Philadelphia Section, AATCC: *ibid* **43**, P859 (1954).

(5) Mushoff, H: *J Soc Dyers Col* **73**, 543 (1957).

(6) Valko, E: *Trans Faraday Soc* **31**, 230, 254 (1935).

(7) Horsfall, R S, and Lawrie, L G: "The Dyeing of Textile Fibers," Chapman and Hall Ltd, London, page 88 (1949).

(8) Lomas, H: *Proc Third Canadian Textile Seminar*, page 64 (1952).

NOTE

YOUR attention is called to the article, "Establishing a Radiochemical Laboratory" by Irving A Berstein, which appeared on pages P297-8; P309 of the May 5, 1958 issue.

The material cited in references **13** and **25** may be obtained from the Office of Technical Services, U S Dept of Commerce, Washington 25, DC; material cited in references **14-19**, from USAEC, Div of Civilian Application, Isotopes Extension, 1717 H St NW, Washington, DC; material cited in references **20-23**, from the supt of documents, Washington 25, DC.

On page P298, in the paragraph beginning . . . "Chemical manipulations on radioactive materials . . . .", the third sentence should read as follows: "Radioisotope hoods and exhaust ducts which are commercially available ($1500-2000) can be operated at a lower linear velocity of 50-100 linear feet per minute due to special design features."

Proceedings of the
American Association of Textile Chemists and Colorists

Copyright, 1958, American Association of Textile Chemists and Colorists

May 19, 1958

36th Annual Convention———

RECENT DEVELOPMENTS IN ELECTRONIC INSTRUMENTS FOR TEXTILE PROCESSES*

R HOSMER
Electronic Instruments Div
The Foxboro Co
Foxboro, Mass

Electronic instruments have become firmly established as devices for the measurement of temperature and pressure, offering certain advantages over conventional mechanical types long used for these variables. Pros and cons of the two types must be weighed before making a selection.

Such analytical measurements as electrolytic conductivity, pH, oxidation-reduction potential and dielectric determination are made possible by electronic instruments and have extended to the process measurements formerly confined to the laboratory.

More recent developments include flow measurement by magnetic principles—a liquid generates a voltage which is proportional to its flow velocity. Electronic transmitters and controllers which perform the function of pneumatic systems but which operate with the speed of electricity and which eliminate the need for instrument air, are also being developed.

New techniques, such as chromotography, for gas analysis measurements show great promise in this field.

While new electronic developments are frequently alluring, their selection must, as always, be based on probable benefits to the user.

PROPER control of various textile processes requires accurate measurement of many different variables. Temperature, flow, density, and chemical analysis are but a few of the significant variables requiring precise measurement as a basis for automatic control.

Measuring temperature by means of resistance bulbs and thermocouples connected to electronic recorders and indicators results in fast, accurate transmission and speedy response of pen or pointer. Newly developed all-electronic transmitters, receivers and controllers comprise an electronic remote control system having all the advantageous features of the more familiar counterpart, the pneumatic remote-control system.

The recorders and indicators in the electronic system are calibrated to receive the same range of electric values, regardless of the range or type of the variable being measured. It is the function of the transmitter to convert the range of the sensing element to the range of the electronic receiver. This corresponds to the pneumatic system in which the transmitters convert all variables to a common output pressure, such as 3-15 psi.

This new electronic system offers many advantages over conventional electronic systems: reduced panel space, identical receivers for all ranges and types of variables, calibration relatively unaffected by transmission distance, and indication at the point of measurement.

The electronic system also has apparent advantages over comparable pneumatic systems: longer possible transmission distances, ease of scanning several measurements, independence from air supplies, greater compatability with data reduction systems. Many of the components used in the electronic control systems, and other recently developed electronic devices, use transistors and magnetic amplifiers for maximum reliability. The extent of this increased reliability will be more apparent, when the electronic systems are used more widely.

The most phenomenal advances in measurement techniques have been recently made in the field of flow. Most flow measurements are accomplished by instruments which measure the differential pressure developed across a line restriction, such as an orifice plate. During the past two years, a flow meter which requires no line restriction and measures flow by the same general principle used by a tachometer generator in measuring speed, has enjoyed tremendous success.

This metering system consists of two units, a transmitter which develops a voltage proportional to the rate of flow, and a receiver which measures and records the generated voltage in terms of flow.

The transmitter consists of a tube, or short length of pipe, with flanged end connections for mounting in a

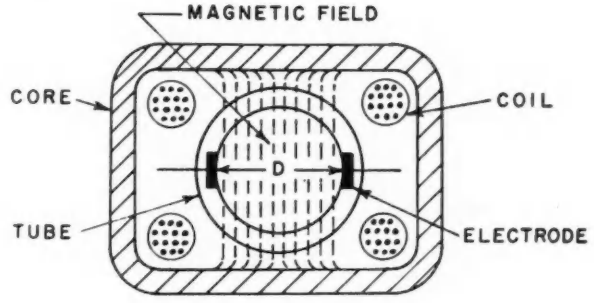


Figure 1
Magnetic field—magnetic flow transmitter

*Presented November 14, 1957 during the 36th Annual AATCC Convention at the Hotel Statler, Boston, Mass.

flow line. Surrounding this tube are magnetic coils and a core, placed so that a uniform magnetic field is produced at right angles to the plane of two electrodes extending into the interior of the tube.

The transmitter unit is designed so that resistance changes resulting from variations in temperature will not appreciably affect the strength of the magnetic field. An insulating liner, covering the entire inner surface of the tube with the exception of the electrodes, prevents the metal tube from shorting the voltage generated by the flow.

Figure 1 shows that the transmitter is an application of Faraday's Law. The liquid to be measured is a moving conductor which passes through the magnetic field. The length of the conductor is the distance between the electrodes across the inside diameter (D) of the tube. The liquid is analogous to a continuous stack of discs equal in diameter to the inside diameter of the tube. A voltage is generated in each disc, or segment of liquid, just as it would be in any conductor passing through a magnetic field. The two electrodes sense this voltage, which increases at the rate of about one millivolt for each foot per second increase in flow rate. The voltage obtained is a simple, direct and linear measurement of volume flow rate.

The transmitter operates with an alternating magnetic field, with the result that an alternating voltage is generated across the electrodes. This provides freedom from the galvanic effects and spurious voltages which would occur at the electrodes with a DC field. Furthermore, DC operation would mean that an extremely bulky and costly permanent magnet would be required on the larger size meters in order to avoid interference from the earth's own magnetic field. Figure 2 shows the transmitter with the cover removed.

The receiving instrument is of the electrical self-balancing type. The measuring circuit, shown in Figure 3, is in electrical balance when the pen or pointer is at the correct reading.

A two-wire cable carries 115-volt, 60-cycle power to the transmitter to actuate the magnetic field. The same cable is extended and connected to the receiver.

A two-wire shielded cable carries the generated voltage from the transmitter to the receiver. The generated voltage is connected in series opposition to the balancing voltage by means of a differential transformer unit mounted in the receiving instrument. Its output is varied by a copper ring linked to and operated by the drive shaft of a solenoid motor. The pen movement is, in turn, linked to the drive shaft of this solenoid motor.

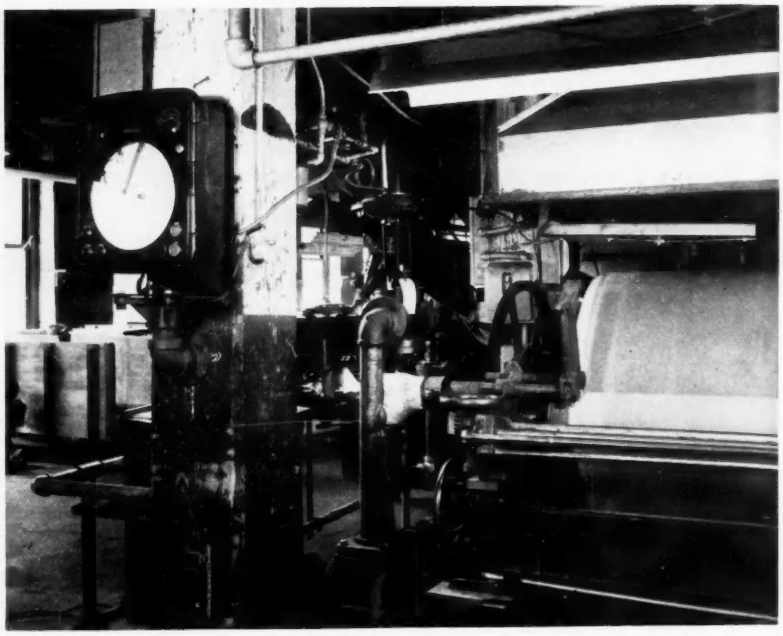


Figure 2
Exploded view—magnetic flow transmitter PH 7201

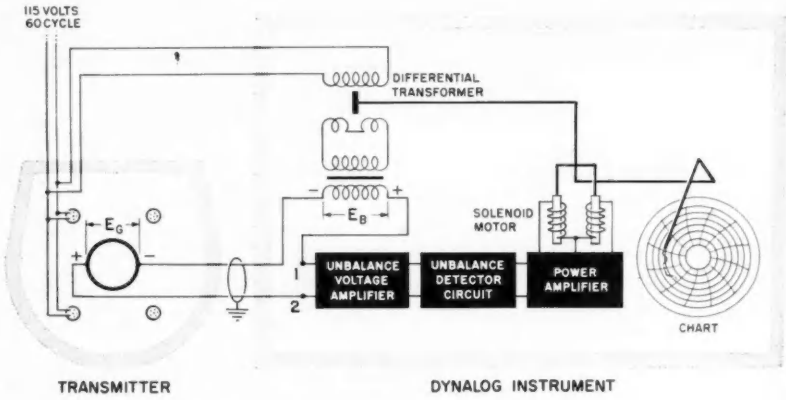


Figure 3
Dynalog instrument—magnetic flow schematic circuit

When a condition of null-balance exists, the sum of the voltages from Point 1 to Point 2 around the circuit is zero. If a change in flow occurs, the Voltage E_G generated by the transmitter will differ from E_B (produced by the differential transformer). This causes a net voltage to appear at the amplifier input which is amplified electronically.

This amplified voltage is compared in phase with the line voltage at the unbalance detector circuit. The detector circuit and the power amplifier then cause unequal currents to flow through the two windings of the solenoid motor, causing the pen to move upscale or downscale depending on whether the flow has increased or decreased.

The pen and copper ring move until null-balance is restored and the voltage produced by the differential transformer is equal and opposite to that generated by the flow transmitter. At balance the currents through the solenoid motor windings are again equal.

The magnetic flow metering system will measure any conductive

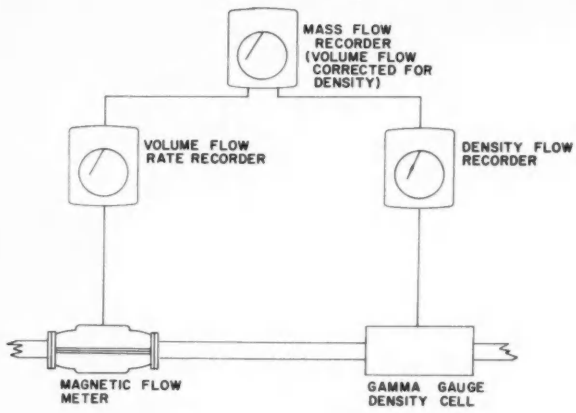

MASS FLOW RECORDER (VOLUME FLOW CORRECTED FOR DENSITY)
VOLUME FLOW RATE RECORDER
DENSITY FLOW RECORDER
MAGNETIC FLOW METER
GAMMA GAUGE DENSITY CELL

Figure 4
Mass flow system—schematic

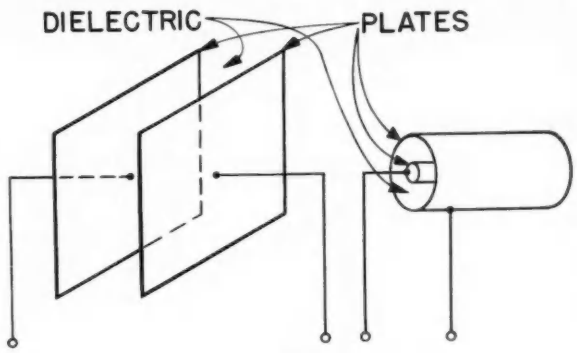


Figure 5
Capacitor plates—flat and concentric

liquid, even if the conductivity is as low as a few micromhos, such as pure water, for example. It provides a highly accurate volume flow measurement, unaffected by changes in liquid density, viscosity, turbulence, or any of the other factors which normally upset flow measurement accuracy. Since the electrical output to the receiver is directly proportional to flow, the receiver scale is linear. Accuracy is ±1 percent of scale at any reading from maximum down to zero flow.

Of main interest to the textile industry, in addition to the linear scale, the accuracy and the absence of extraneous effects on flow, is the fact that the meter will measure highly corrosive liquids and that it adds no pressure drop—an important consideration in the measurement of water or mill effluent.

To obtain the needed measurement of pounds per hour of material, it is sometimes necessary to measure *mass* flow, rather than the *volume* flow rate achieved by the magnetic flow meter. The conversion of volume to mass flow measurement can be done automatically by adding a density measurement to correct volume flow rate for changes in the density of the liquid. The output of a Gamma gauge density cell is recorded on an electronic recorder; volume flow is recorded on a magnetic flow meter recorder. By means of differential transformers, each recorder retransmits an output proportional to the recorded measurement. These are combined by a third recorder to provide a record of mass flow. (Figure 4).

Another type of electrical measurement which has proved useful in a small, but increasing, number of textile applications is dielectric constant, a specific property of insulating materials, both liquid and solid. Knowing the dielectric constant of each of two liquids in an emulsion, it is then possible to measure the per cent concentration of each with respect to the other by measuring the dielectric constant of the emulsion.

Since C (capacitance) is proportional to K (dielectric constant) times A (area of capacitor plates) divided by d (distance between plates,) the formula is $C : \frac{KA}{d}$ in which capacitance changes are caused only by variations in K with the dimensions of the capacitor kept constant. Figure 5 shows two types of capacitor.

Most existing applications of dielectric measurement are in fields other than textile but these uses may be helpful in suggesting similar possibilities in textile work. Chemical plants, for instance, use dielectric measurement to determine per cent composition of acetic anhydride (K=20) in acetic acid (K=6.15). In all such applications, the number of variables must be limited to two and their dielectric constants must be significantly different. Pipeline operators use capacity instruments to detect small amounts of moisture in crude oil, a successful measurement because water has a dielectric constant of 80 and crude oil about 2.3. Figure 6 shows the relationship of K and per cent moisture for three different crudes.

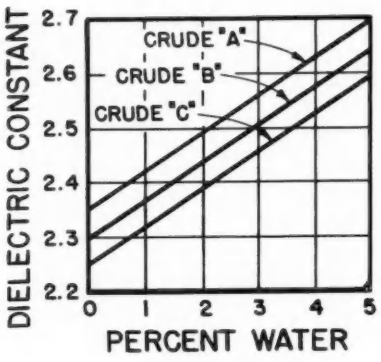


Figure 6
Dielectric constant—percent water and crude

Capacity instruments are also used to measure liquid level, with a metal rod inserted in a tank as shown in Figure 7. The probe, insulated electrically from the tank, is one plate of a capacitor. The other plate is formed by the metal walls of the tank. The space between them contains the dielectric. As the level rises, air, which has a dielectric constant of 1, is replaced by process liquid of a higher dielectric value. The capacitance increases linearly and a measurement of level is obtained.

If the process liquid is a conductor rather than an insulator, the metal probe must be coated with an insulating material to prevent short circuiting of the system.

Electronic instruments offer a transmission advantage where central control rooms and the instrumented process are long distances apart—a trend in modern plant design. The textile mill supplied with water from distant reservoirs needs a way to transmit readings of water level, a measurement vital to the operation of the entire mill. Yet, the distances involved often rule out pneumatic transmission. If the distance is a mile or two, electronic instruments can receive the measurement by direct connection to the measuring elements. For greater distances telemeter transmitters and receivers are used—the transmission medium being telephone lines, private wires or wireless links. Telemeter signals are generally time-impulses, counted pulses, or tones.

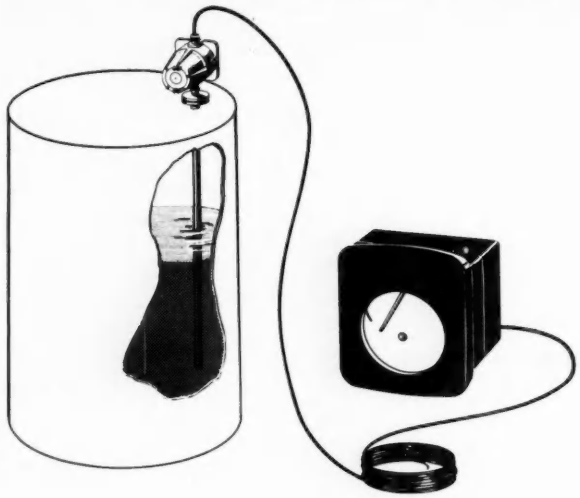


Figure 7
Capacitance level system

Numerous other electronic measurements are familiar to you. For example, electrolytic conductivity is being used to determine per cent composition of aqueous solutions of acids, bases and salts. pH measurement for acidity or alkalinity determinations has been further refined. Oxidation-reduction potential gives end points of reactions and is being used to measure the ratio of oxidant to reductant in solution.

From these brief descriptions of modern electronic instrumentation at work in textile and other industrial plants, it can be seen that much progress has already been made, both in instrument design and in utilization. Future instrument developments and more complete use of existing instrumentation are certain to offer even greater opportunities for improved textile processing techniques.

Automatic logging systems and computing controllers, although now in their infancy, will certainly be used on a vastly greater scale in the near future. They provide an accurate log of measurements from which costs can be analyzed and plant efficiency evaluated. They eliminate the need for manually recording data on log sheets. These systems are particularly valuable during process upsets, for they can scan and record quickly the values of the many different measurements involved.

Computing controllers promise to replace some of the present day control functions performed by the human operator. The computor will gather and analyze process data and adjust the controller to provide optimum results of efficiency, safety, productivity and quality.

Computer techniques are advancing to a point where the primary measurement is a limiting factor. Many of the existing inferential measurements are limited in that they do not analyze the stream directly.

The development of end product analyzers and data processing equipment will make it possible for systems engineers to apply feed-back control principles to the over-all operation of process plants. Previously the application of feed-back principles was limited to control of primary variables such as flow, temperature and pressure. The application will now be extended to secondary variables such as yield, efficiency, and product quality, since these can be computed by data processing systems in fractions of a second.

Measurement and data processing systems should be designed to help the operator, the technical staff, and the managerial staff. The system design should be governed by the actual requirements of the process as determined by these groups individually and collectively.

The key member of the team creating a system design is the individual who is assigned the task of integrating the interests of all the groups, and is the "systems engineer" for the project.

A good systems engineer should have the following qualifications:

a) Intimate knowledge of the latest techniques and devices for measurement, control, and data processing.
b) Experience in the application, installation, and operation of measurement, control, and data processing devices.
c) Ability to collect and evaluate information from all levels of personnel involved—from operator to plant manager.
d) General familiarity with the physical plant and its processes.

Frequently the systems engineer is not a member of the plant staff, but is an independent consultant or is associated with equipment manufacturing firms.

There are several examples of system design where the "systems engineer" was a member of an instrument manufacturer's engineering staff. One system, installed in a large gasoline plant, features an information center with continuous scanning of several hundred temperature points. The system blends the latest analog and digital techniques with conventional instrumentation and graphic data displays. Another system, for a paper mill, utilizes "on-line" analog computers in conjunction with telemetering devices to present selected data on plant performance to supervisory personnel. The selection of the particular data processing techniques for these two systems was dictated solely by engineering considerations.

As progress is made in the development of instruments and techniques in various processes it is certain that more methods adaptable to textiles will be made available.

TEAR SHEETS AVAILABLE

Tear sheets of articles which have appeared in AMERICAN DYESTUFF REPORTER since July, 1956 are available in limited quantities. (Consult year-end indexes for list of titles). These may be obtained by sending a stamped, self-addressed envelope along with a request for the specific articles. Write TEAR SHEETS, American Dyestuff Reporter, 44 East 23rd St, New York 10, NY.

36th Annual Convention———

PREVENTION OF WOOL FABRIC SHRINKAGE WITH POLYAMIDE-EPOXIDE RESIN FINISHES*

C E PARDO and R A O'CONNELL
Western Regional Research Laboratory
Western Utilization Research and Development Div
Agricultural Research Service
U S Dept of Agriculture
Albany 10, Calif

This paper describes the preparation, application and curing of polyamide-epoxide resins on a wool flannel fabric to control its shrinkage during laundering. Excellent shrinkage protection is obtained with aqueous resin dispersions containing between 30 to 70 parts by weight of either the polyamide or epoxide resin component at uptake levels of 3.5 to four percent. It is shown that the degree of shrinkage resistance is related to the development of fabric rigidity which, in turn, is governed by the relative proportions of resins in the formulation, amount deposited on the fabric, and the curing conditions employed.

INTRODUCTION

SYNTHETIC polymers and prepolymers have been the subject of considerable investigation as finishes for reducing or eliminating the felting shrinkage which normally occurs when wool fabrics are laundered. These materials stabilize against shrinkage in several ways (*1*). A reactive monomer or prepolymer, when deposited internally in the fiber, can inhibit felting shrinkage either through increasing the work necessary to stretch the fiber or by impairing its elastic recovery properties. External deposits of polymer function either through masking the scale edges, thereby reducing the differential friction effect, or by interfiber resin bonding, which restricts fiber migration during laundering.

Examples of a few of the many polymeric materials which have been described as effective shrink-resist agents for wool include polyglycine (*2, 3*), methylated melamine-formaldehyde (*4*), polysiloxanes (*5*), and, more recently, linear N-alkylated polyamides (*6-10*). Numerous other polymers also have been investigated with perhaps the melamine resins enjoying the greatest commercial acceptance.

In the protective-coatings field, low-temperature polyamide-polyepoxide systems have been described (*11*), which give tough, flexible films characterized by excellent adhesive properties. Application of these to wool to control felting shrinkage has not been previously described. A description of the properties of such a system is of interest because it has been found that proper choice of conditions gives excellent control of felting shrinkage. The purpose of this study was to determine the effect of polyamide-epoxide resin finishes on wool shrinkage in relation to conditions of application and the resultant effects on other important fabric properties, such as tensile and tear strengths, wrinkle recovery, and flexural rigidity.

*Presented by C E Pardo on November 16, 1957 during the 36th Annual AATCC Convention at the Hotel Statler, Boston, Mass.

EXPERIMENTAL

POLYAMIDE RESIN—The polyamide resin (Versamid 115†) was used as supplied without further purification. It is a condensation product of a polyfunctional amine, such as diethylene triamine, with heat-dimerized unsaturated fatty acids, such as linoleic (*12-14*). The polyamide resins are related to nylon, but, because they have reactive secondary amino groups along the polymer chain and are structurally more complex, their chemical and physical properties differ from those of nylon.

The resin was applied to the fabric alone or in mixtures with the epoxide resin described below. In either case the resin was applied from an alcoholic solution or as an aqueous suspension of the polymer. The alcoholic solutions were prepared by dissolving the required amount of resin in 80% ethanol. For aqueous suspensions, the resin was dissolved in acetone to give a solution containing one gram of resin to one cc of acetone; this solution was stirred into the required weight of water containing five percent nonionic detergent (Triton X-100) based on resin weight.

EPOXIDE RESIN———The epoxy resin employed (Epon 562) is a reaction product of epichlorohydrin and glycerol containing on the average a little more than two epoxy groups per mole of glycerol (*15, 16*). Reaction between the polyamide and epoxide resins occurs between the NH groups of the polyamide and the oxirane ring of the epoxide forming a direct C-N link between the resins. Since this reaction occurs at relatively widely spaced points along the polymer chain, the resultant copolymer shrinks very little on curing.

The epoxide was used as supplied and was also applied from alcoholic solutions or aqueous suspensions. Alcoholic solutions were prepared in the same way as those of the polyamide. Aqueous dispersions were prepared by mixing the required weight of resin with water containing 5% nonionic detergent (Tween 40) based on resin weight and agitating for one minute in a high-speed blendor. Preparation and application of mixtures of polyamide and polyepoxide resins are described later in this paper.

WOOL FABRIC———A 6.12-oz/sq yd wool flannel fabric with worsted warp (64s quality) and woolen fill (70s quality) containing 55 ends and 46 picks per inch was used for all work described. To insure that the fiber surface was free from impurities (*10*), the wool was extracted for 12 hours each with ether and ethanol in a Soxhlet extractor and rinsed thoroughly with five changes of distilled water. It was dried overnight at 45°C and conditioned at 70°F and 65% relative humidity. Five-inch-square swatches, conditioned and weighed before and after treatment, were generally used.

†Mention of specific commercial products in this paper does not imply endorsement by the Department of Agriculture over others of a similar nature not mentioned.

TABLE I

Area shrinkage of wool fabric treated with alcoholic solutions of Versamid 115 and Epon 562

	Treatment[1]	Area Shrinkage (%)
1	5% Epon 562 followed by 10% Versamid 115	18.1 18.4
2	5% Epon 562	21.6 19.9
3	10% Versamid 115 followed by 5% Epon 562	+2.8[2] +1.0
4	10% Versamid 115	21.7 21.7
5	Versamid 115:Epon 562/90:10 (10% resin solids) mixed together prior to application	4.7 1.0
	Untreated controls	33.7 35.1

[1]The fabric was dried and cured for 60 minutes at 105° C following the application of each resin in treatments 1 and 3. In treatments 2, 4, and 5 the fabric was dried and cured for 120 minutes at 105° C.
[2]Plus values indicate an increase in area.

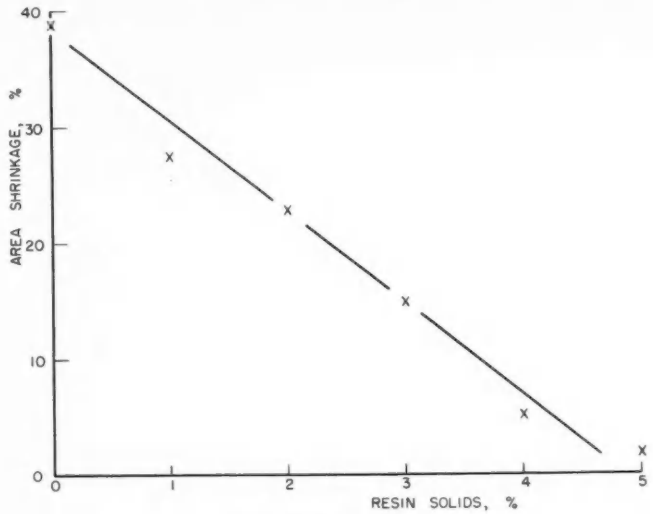


Figure 1
Effect of resin concentration on area shrinkage.
Resin formulation, Versamid 115: Epon 562/50:50, padded on at 100% pickup owf; cured one hour at 105°C.

SHRINKAGE TESTS ——— The Accelerotor (*17*) was used to test the relative effectiveness of the various resin treatments in preventing shrinkage. A home agitator-type washer was also used to test larger-sized treated fabric. Duplicate five-inch squares of fabric, their edges bound with Duco cement (thinned *ca* 1:1 with ethyl acetate) to prevent ravelling, were conditioned in 1% sodium acetate at 40°-50°C for one-half hour prior to the test and rinsed thoroughly in distilled water. Water was expressed from the fabric by hand. Each swatch was laid out flat without tension, and dots were inked on the fabric with a template to mark off three 10-cm distances in both the warp and fill directions, so as to allow three separate measurements to be made in each direction. The Accelerotor test chamber was preheated with several changes of hot water (40°-50°C). Two swatches were then placed in the chamber followed by 200 ml of a 0.5% sodium oleate solution at 40°-42°C. The machine was run at 1500 rpm for three minutes. The samples were removed, rinsed for 10-15 minutes in running tap water, squeezed, and remeasured. Warp, fill, and area shrinkages were calculated. Under these accelerated test conditions, the percentage area shrinkage of 12 untreated five-inch-square pieces of flannel was 38.1% with a standard deviation of ±2.8.

With the following exceptions, AATCC Tentative Test Method 41-52, Dimensional Changes in Wool Textiles (*18*), was followed in testing the shrinkage of larger (20-inch-square) pieces of fabric. An agitator-type home washer was used in place of the wash wheel and 0.015% Calgon and 0.1% sodium oleate added to the wash water. The fabric was washed 75 minutes at 38°C and rinsed in the automatic rinse cycle with a three-minute deep rinse followed by two half-minute spray rinses.

TEAR TEST———To measure tear strength, the Elmendorf falling-pendulum tester was used in accordance with ASTM test method D 1424-56T (*19*).

WRINKLE RECOVERY ——— To measure wrinkle recovery, the Monsanto Wrinkle Recovery Tester was used with a one and one-half pound weight in accordance with ASTM test method D 1295-53T.

TENSILE STRENGTH ——— Dry strength and elongation were determined using the cut-strip method, ASTM D 39-49.

STIFFNESS PROPERTIES ——— The cantilever method, ASTM D 1388-55T, was used to evaluate stiffness and flexural rigidity.

TREATMENTS AND RESULTS

ALCOHOLIC SOLUTIONS OF POLYAMIDE-POLYEPOXIDE RESINS———In order to favor continuous resin-film coverage of the fiber, the resins were first applied from alcoholic solutions. Separate solutions of the two resins were prepared by dissolving 10% polyamide (w/v) and 5% polyepoxide (w/v) in 80% ethanol. Duplicate swatches of wool were each treated in one of five different ways by applying the resins as follows:

Treatment 1: The fabric was padded through a solution of epoxide resin twice to give a final wet pickup of 125% on weight of the conditioned fabric (owf), dried at 50°C for 20 minutes and cured at 105°C for 60 minutes. After this, the wool was treated in the same way by padding through the alcoholic polyamide solution, drying and curing. *Treatment 2:* The same as treatment 1, except that only epoxide resin was applied. The curing time was increased to 120 minutes to compare with the total curing time of treatment 1. *Treatment 3:* The same as treatment 1, except that the order of application was reversed—the polyamide was applied first, followed by the epoxide resin. *Treatment 4:* Application of polyamide only with 120-minute curing time. *Treatment 5:* Alcoholic solutions of polyamide and epoxide resins were mixed in a weight ratio of polyamide to polyepoxide of 90 to 10 to give a final solution containing 10% resin solids (w/v). The wool was padded through this solution, dried and cured in the same manner as in treatment 2. The Accelerotor shrinkage results given in Table I indicate clearly that the effectiveness of the resin treatment depends on the order and manner of application. Good protection is obtained when the polyamide is applied and cured on the fabric before applying the epoxide resin. This is also true when the two resins are mixed prior to application. On the other hand, if the order of application is reversed or the fabric treated with either resin alone, the shrinkage resistance is relatively poor.

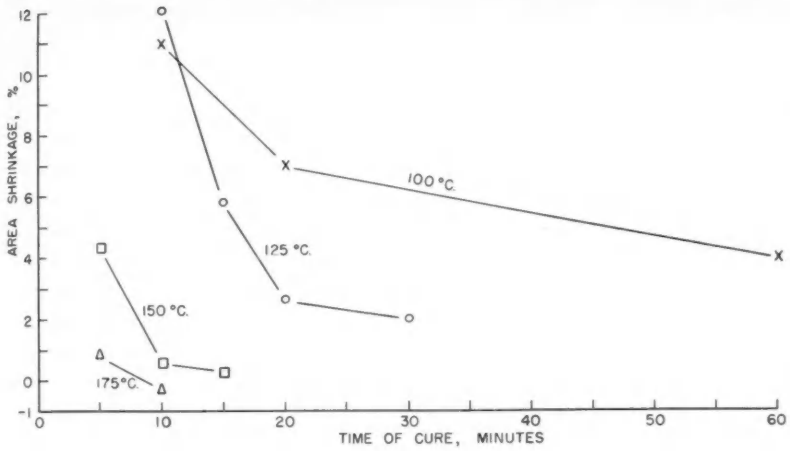


Figure 2

Effect of cure time and temperature on area shrinkage.

Resin combination, Versamid 115: Epon 562/50:50. Percent resin deposited on fabric, 3.9.

TABLE II

Area shrinkages and weight loss of resin-treated wool fabric extracted with hot water

Versamid 115/ Epon 562 (wt)	Resin deposited (%)	Area shrinkage (%) Cure A[1] Unextracted	Extracted[2]	Resin loss (%)	Area shrinkage (%) Cure B[1] Unextracted	Extracted[2] after Cure A
50/50	5.2	15.4	2.4	17.2	1.0	1.0
90/10	4.4	30.9	33.9	48.1	18.3	2.7
10/90	4.1	18.8	17.0	44.8	12.5	9.5

[1] Cure A: 85° C for 60 minutes.
Cure B: 85° C for 60 minutes + 105° C for 180 minutes.
[2] Extracted for 60 minutes in running tap water 52°-54° C.

ONE-STEP TREATMENTS WITH AQUEOUS DISPERSIONS OF POLYAMIDE - POLYEPOXIDE RESINS———For practical use, a treatment based on resin deposition from an aqueous medium is preferred to a treatment requiring solvents. The effectiveness of treating the fabric with aqueous resin dispersions was therefore studied and all results hereinafter described are based on treatments of wool with these dispersions. Resin suspensions of one to five percent resin solids containing 50 parts by weight of polyamide to 50 parts of polyepoxide were prepared by mixing the two resin suspensions, prepared separately as previously described, in the proper proportion immediately prior to treatment. Duplicate samples were padded through the dispersion twice at 100% wet pickup owf, dried at 50°C for 20 minutes, and cured at 105°-110°C for 60 minutes. In Figure 1, the results show that shrinkage protection increased linearly with resin concentration. Approximately five percent resin owf was needed to secure complete protection under the curing and shrinkage conditions used.

WATER AND SOLVENT EXTRACTION OF THE RESIN FINISH———Next, the fastness of the resin finish and its effectiveness in resisting extraction with hot and boiling water and with Stoddard solvent were examined. Three sets of eight five-inch squares of fabric were treated with aqueous dispersions containing four percent resin solids. Each set was treated separately with polyamide-epoxide resin combinations containing, respectively, 90:10, 50:50, and 10:90 parts by weight of each resin and cured at 85°C for 60 minutes. One pair of swatches from each set was set aside for shrinkage testing. A second pair was dried an additional three hours at 105°C to obtain the amount of resin deposited in the fabric, shrinkages being determined on these samples also. The remaining two pairs of each were extracted for 60 minutes in running tap water at 52°-54°C. One pair was set aside for shrinkage testing and the other dried at 105°C for three hours to determine the weight loss on extraction prior to testing for shrinkage.

Measurements of shrinkage and loss of weight on extraction given in Table II show that the 50:50 formulation is better than the other two resin dispersions tested in both shrinkage resistance and stability to extraction with hot water. It is also evident that shrinkage resistance improves with increasing time and temperature of cure. Hot water extraction, when followed by additional curing, also resulted in improved shrinkage resistance despite the loss of almost half of the original resin deposited from the 90:10 and 10:90 formulations. These results suggest that additional curing of the resin occurred during extraction. At the lower curing temperature (60 minutes at 85°C), only the 50:50 formulation showed this improvement.

TABLE III

Area shrinkages of resin-treated wool fabric extracted with boiling water and Stoddard solvent

Resin deposited, (%)	Extraction treatment	Area shrinkage, (%)
None	None	40.0
None	Distilled water, one hr at 100° C	27.6
4.8	Distilled water, one hr at 100° C	2.1
6.0	None	2.4
6.2	Stoddard solvent, 3.5 hr at 50° C	0.8

Fabric treated with Versamid 115:Epon 562/50:50 resin dispersion containing 5% resin solids. Cured 60 minutes at 105° C.

Fabric treated with the 50:50 formulation, dried and cured one hour at 105°C and then either boiled one hour in distilled water or immersed for three and one-half hours in Stoddard solvent at 50°C, still retained its shrinkage resistance, as shown in Table III.

The improved protection obtained by either increasing the temperature and time of cure or extracting the fabric in hot or boiling water prompted further investigation of curing conditions.

OVEN CURE: EFFECTS OF TIME AND TEMPERATURE———Accordingly, wool flannel, treated to contain 3.9% solids of the 50:50 resin formulation, was examined for shrinkage resistance and the development of rigidity in the unwashed fabric following oven-curing over times ranging from five to 60 minutes at temperatures from 100°C to 175°C. The results are shown in Figures 2 and 3. Figure 2 relates the shrinkage resistance to time and temperature of cure. The results obtained indicate that the effectiveness of the shrink-resistant finish increases with increasing time or temperature of cure, and that higher temperatures of cure (125°-175°C) are required to stop

shrinkage effectively. Figure 3 compares shrinkage to the development of rigidity in the resin-treated unwashed fabric at various curing temperatures. The results show that shrinkage protection is regularly accompanied by increased fabric stiffness.

It should be noted that the measurements relating the rigidity to shrinkage were made on unwashed fabric. The accelerated wash procedure decreased the stiffness of the resin-treated fabric to a value approximating that of the untreated control fabric.

CURE IN BOILING WATER AND BUFFER SOLUTIONS: EFFECT OF pH———Next, the shrinkage resistance of the resin-treated fabric was examined after the fabric was boiled for an hour at various pH's. Two pieces of fabric, 7″ x 54″, were padded through 50:50/polyamide - epoxide resin dispersions containing two and three percent resin solids, respectively, and dried at 50°C for 20 minutes. Duplicate five - inch - square swatches were cut from each piece and cured by boiling for 60 minutes in buffer solutions at pH 3, 5, 7, and 9, and in distilled water (final pH: 8). Untreated control swatches were treated separately by boiling for the same length of time in distilled water and buffer solutions. After boiling, both resin-treated and untreated samples were washed thoroughly in distilled water, conditioned for one hour in one percent sodium acetate, and rinsed again with distilled water before testing for shrinkage in the Accelerotor. Figure 4, relating pH of cure to area shrinkage, shows that boiling under neutral to basic conditions results in marked improvement in shrinkage resistance over that obtained when the fabric is boiled under acid conditions or given an oven cure at 105°C for one hour (Figure 1).

APPLICATION OF RESIN TREATMENT BEFORE AND AFTER DYEING———In order to compare the relative effectiveness of resin treatments applied before or after dyeing, three 20-inch-square, solvent-extracted pieces were treated as follows. Pieces A and B were dyed with one percent owf Fast Wool Red GL 150%. Piece A was set aside as a control for the shrinkage test. Piece B was treated with a polyamide:epoxide/50:50 dispersion containing five percent resin solids at 100% pickup owf. The undyed piece C was treated with a portion of the same resin dispersion used to treat B. Both pieces

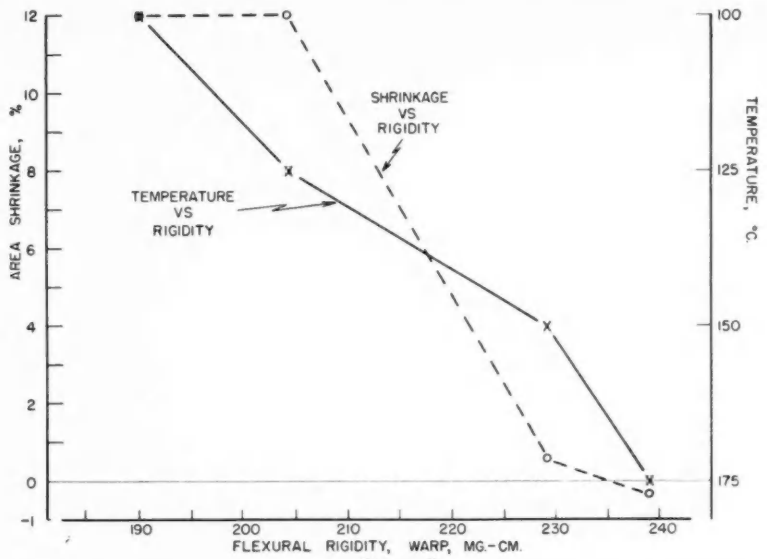


Figure 3

Relationship between area shrinkage and fabric rigidity at various curing temperatures. Treated with Versamid 115; Epon 562/50:50 to contain 3.9% solids. Cured 10 minutes at temperatures shown.

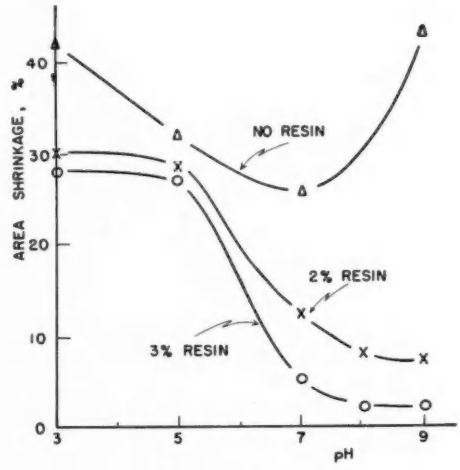


Figure 4

Shrinkage of resin-treated fabric cured in various buffer solutions at 100°C.

TABLE IV
Shrinkage of wool fabric treated with resin before and after dyeing

		Percent shrinkage					
		1st Wash			2nd Wash		
	Order of Treatment.	Warp	Fill	Area	Warp	Fill	Area
A)	Dyed—no resin treatment	19.9	26.9	35.5	32.3	33.4	54.9
B)	Dyed, resin-treated, cured	1.0	1.1	2.1	6.9	6.2	12.6
C)	Resin-treated, cured, dyed	0	+0.5	+0.5	0.1	0	0.1

Cured 60 minutes at 105° C. Dyed 1 hour at boil in solution containing one percent Fast Wool Red GL 150% owf (wool to solution 1:35) and 10% Glaubers salt and sodium bisulfate, respectively, (pH 2.2).

Washing test: AATCC 41–52, each wash 75 minutes in 0.1% soap and .015% Calgon at 38° C in an agitator-type home washer.

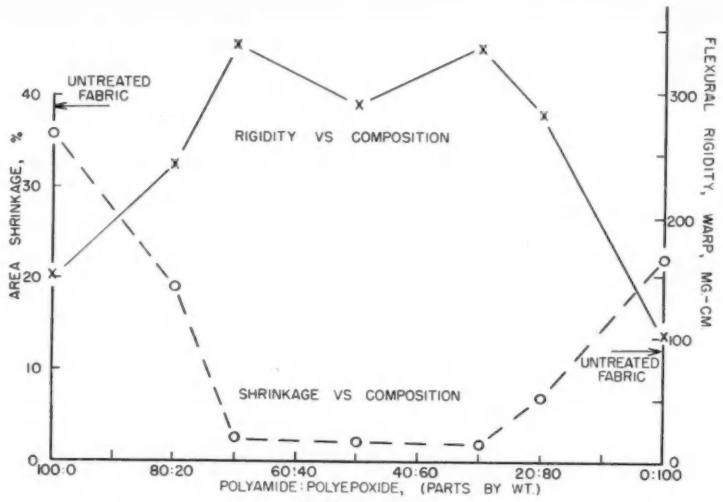


Figure 5
Effect of resin composition on shrinkage and flexural rigidity.
Curing conditions: 30 minutes at 125°C.

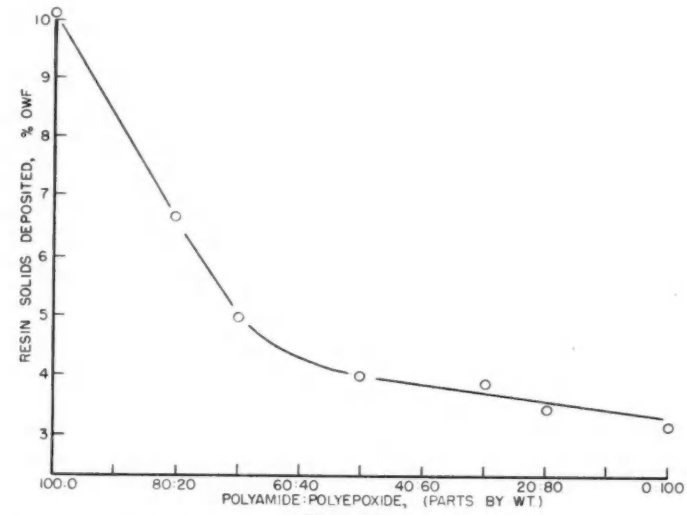


Figure 6
Substantivity of various resin combinations.
For purposes of comparison, the actual weight gains (Table V) were corrected on the basis of 100% wet pickup.

were then dried at 50°C for 45 minutes and cured at 105°C for 60 minutes. Piece C was then rinsed in distilled water and dyed in the same manner as A and B. All three samples were thoroughly rinsed in distilled water and conditioned in one percent sodium acetate before the shrinkage test. The pieces were given two 75-minute accelerated wash tests in the domestic washing machine. Although the resin finish is not properly cured when boiled under acid conditions (Figure 1), shrinkage results shown in Table IV indicate that the resin finish is fast to acid dyeing provided it is given a precure.

TABLE V
Fabric properties

Wt ratio Versamid 115: Epon 562	*Resin deposited* (%)	*Area shrinkage* (%)	*Tensile strength* (lbs)	*Elongation* (%)	*Bending length* (cm)	*Flexural rigidity* (mg-cm)	*Crease recovery* (%)	*Elmendorf tear* (gms)
100:0	9.1	35.7	27.4	34.6	1.88	152	87	1440
80:20	6.3	19.0	27.6	34.9	2.22	244	96	1356
70:30	4.6	2.5	28.0	35.3	2.50	344	88	1356
50:50	3.6	2.0	27.2	36.5	2.38	294	87	1356
30:70	3.5	2.0	26.9	33.8	2.50	339	87	1369
20:80	3.2	6.9	27.2	33.2	2.36	284	87	1516
0:100	3.7	22.6	23.6	25.0	1.70	107	82	1837
—	None	36.0	25.6	30.7	1.64	88	84	1606

Resin deposition based on weight of fabric conditioned at 70° F, 65% relative humidity.

VARYING PROPORTIONS OF POLYAMIDE TO EPOXIDE RESINS——Since the hardness, flexibility, and adhesiveness of polyamide-epoxide resin combinations can be altered by varying the ratio of the components (*11*), it appeared likely that certain proportions of the reactants would be more effective than others. Accordingly, dispersions of four percent resin solids containing various proportions of the polyamide-epoxide resins were padded onto pieces of fabric to a wet pickup of 90%. The pieces were dried and cured at 125°C for 30 minutes. From each piece of fabric, two samples were taken for shrinkage determinations and six warp and fill samples for tensile strength, tear strength, wrinkle recovery, and stiffness measurements. The physical properties of the resin-treated unwashed fabric are shown in Table V, for each of the treatment combinations used. For the sake of brevity, only the warp values are included in the table. A fourfold increase in the overall flexural rigidity along with a five to nine percent increase in tensile strength and three to five percent increase in the wrinkle-recovery characteristics was observed in fabrics treated with the formulations in which the proportion of the two resins varied from 3:7 to 7:3. A decrease of approximately 15% in tear strength was observed in the fabric which shrank the least. Figure 5 shows that these same fabrics also developed the greatest flexural rigidity. Previous investigators (*5, 20*) have found that the effectiveness of a polymer finish in preventing felting shrinkage depends in part on the rigidity and hardness of the polymer used, the harder polymers being more effective. Figure 6 shows that the fabric takes up the resin more completely as the proportion of polyamide is increased. In the region where the weight ratio of polyamide to epoxide resin is 50:50, the resin deposited (at 100% wet pickup owf) corresponds to the concentration of resin solids in the dispersion.

ALLWOERDEN REACTION——The Allwoerden reaction (*21, 22*) was used to study modification of the surface-scale structure by treatment

with the various resin formulations. The action of saturated bromine water on fibers teased from the warp and fill yarns of the fabric resin-treated in the preceding experiment was compared with control fibers from untreated fabric. Allwoerden bubbles appeared at irregular intervals along the untreated fibers, indicating that the epicuticle had suffered some damage during the processing of the fiber into fabric. Fibers treated with the polyamide-epoxide resin formulations in which the polyamide component made up 80% to 100% of the resins were observed to have globules of resin clinging to the edges of the fibers. In these fibers the Allwoerden reaction was similar to that observed in the control fibers. No globules of resin appeared on the fibers obtained from the fabrics treated with polyamide-epoxide formulations in which the amount of polyamide in the total resins was 30% to 70%. In these fibers, formation of Allwoerden bubbles was almost completely suppressed. Fibers treated with resin formulations containing 80% or more of the epoxide resin component gave no Allwoerden reaction.

DISCUSSION

FACTORS IN SHRINKAGE CONTROL BY RESIN APPLICATION—Suppression of the Allwoerden reaction presumably results because either 1) a coherent resin coating reinforces the epicuticle or changes its permeability in such a way as to prevent it from forming typical Allwoerden sacs, or 2) the epoxide resin component reacts with or in the wool keratin (exocuticle) immediately underlying the fiber surface, either protecting the keratin from reaction or increasing the size of the soluble products so that they no longer have the necessary osmotic effect. It is probable that both reactions take place to some extent. For the first to occur, the resin must be able to spread more or less evenly over the fiber surfaces. In the formulations containing larger proportions of epoxide resin, it is suggested that the intermolecular cohesive forces of the polyamide are reduced by the reaction of a greater proportion of the NH groups of the polyamide with epoxy groups of the epoxide resin, permitting the resulting copolymer to spread more evenly over the fibers. Jackson (7), in his work on substituted nylon polymers, attributes the failure of unsubstituted nylon to protect against felting shrinkage to failure of the polymer to spread over the fibers. Proper flow characteristics were obtained by substituting N-methoxy methyl groups into the polyhexamethylene adipamide, thus reducing the high intermolecular cohesive forces of the unsubstituted polymer.

The fact that no Allwoerden reaction could be induced in fibers treated with formulations containing only the epoxide resin may be taken as evidence that the second mechanism suggested also takes place. The ability of wool keratin to react with epoxides is supported by unpublished investigations by W G Rose of this laboratory who showed, for example, that weight gains of the order of three percent were observed when wool was treated with the diglycidyl ether of ethylene glycol at 50° C for 24 hours. Wool so treated did not lose weight as a result of repeated washing in water and ethanol. No significant shrinkage protection was found in these modified fabrics.

The mechanism by which the treatment operates has not been fully studied, however preliminary measurements of single fibers taken from resin-treated yarn showed no change in the surface friction or elastic properties. An increase in the force-to-break tension at various levels of twist was found in resin-treated single-ply yarn over that of the untreated yarn (23), indicating that the treatment probably operates, at least in part, through interfiber resin bonding.

SUMMARY

The effectiveness of preventing wool shrinkage by treatment with alcoholic polyamide-epoxide resin solutions depends on the order of application. Protection is obtained when the polyamide is applied and cured on the fabric before applying the epoxide or when the two resins are mixed before application. On the other hand, the shrinkage resistance is relatively poor if the order of application is reversed or the fabric treated with either resin alone.

The shrinkage protection obtained by aqueous polyamide-epoxide resin dispersions has been related to concentration and proportions of the resins and the conditions of cure. Excellent shrinkage resistance is obtained with proportions between 30 and 70 parts by weight of either resin at uptakes of 3.5 to four percent. Resin combinations in which the polyamide constitutes 80 parts or more by weight of the total resin fail to protect the fabric from shrinkage. This result is attributed to failure of the polymer to spread over the surface of the fibers so that it adheres poorly to the fabric.

It has been further shown that the degree of shrinkage resistance is associated with development of fabric rigidity. The stiffer the unwashed fabric is after the treatment, the better the protection against felting shrinkage. After washing, the fabric rigidity returns to practically the same value as the untreated control wool. However, shrinkage resistance is retained.

The resin is cured either by dry heat alone or by hot water under neutral or alkaline conditions. Although the resin finish is not properly cured when boiled under acid conditions, if precured at an elevated temperature prior to boiling, the finish is fast to typical acid-dyeing conditions.

The most effective compositions give uniform surface coatings, possibly penetrating the fiber to some extent, and appear to act in part by interfiber bonding.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the encouragement and advice received from Harold P Lundgren and Joseph E Moore in this investigation. Particular thanks are due Irene Stuart and Lura Brown for carrying out most of the physical tests required by this study.

LITERATURE CITED

(1) Jackson, D L C, *Proc International Wool Textile Research Conference*, Vol E, Part 2, 439 (Australia 1955).
(2) Baldwin, A W, Barr, T, and Speakman, J B, *J Soc Dyers Col* **62**, 4 (1946).
(3) Alexander, P, Bailey, J L, and Carter, D, *Textile Research J* **20**, 392 (1950).
(4) Johnstone Jr, E P, and Van Loo Jr, W J (to American Cyanamid), U S Patent 2,329,622 (Sept, 1943), Reissue Patent 22,566 (Nov, 1944).
(5) Alexander, P, Carter, D, and Earland, C, *J Soc Dyers Col* **65**, 107 (1949).
(6) Delmenico, J, Jackson, D L C, and Lipson, M, *Textile Research J* **24**, 828 (1954).
(7) Jackson, D L C, and Lipson, M, ibid **21**, 156 (1951).
(8) Jackson, D L C, ibid **21**, 655 (1951).
(9) Jackson, D L C, ibid **23**, 616 (1953).
(10) Jackson, D L C, ibid **24**, 624 (1954).
(11) Renfrew, M M, Witcoff, H, Floyd, D E, and Glasser, D W, *Ind Eng Chem* **46**, 2226 (1954).
(12) Cowan, J C, Falkenberg, L B, Teeter, H M, and Skell, P S (to United States of America), U S Patent 2,450,940 (Oct 1948).
(13) Cowan, J C, Lewis, A J, and Falkenberg, L B, *Oil & Soap* **21**, 101 (1944).
(14) Schulze, F, and Wittcoff, H, in *Encyclopedia of Chemical Technology* **10**, 932, Interscience Publishers, Inc, New York (1950).
(15) Condo, F E, and Schroeder, C W (to Shell Development Corporation), U S Patent 2,752,269 (June 1956).
(16) Jungnickel, J L, Peters, E D, Polgar, A, and Weiss, F T, *Organic Analysis* **1**, 140, Interscience Publishers, Inc, New York (1953).
(17) Steigler, H W, Glidden, H E, Mandikos, G J, and Thompson, G R, *Am Dyestuff Reptr* **45**, P685 (1956).
(18) American Association of Textile Chemists and Colorists, 1956 *Technical Manual and Year Book*.
(19) American Society Testing Materials, ASTM Standards on Textile Materials, Comm D-13 (Nov 1956).
(20) Boardman, N K, and Lipson, M, *J Soc Dyers Col* **69**, 335 (1953).
(21) Lindberg, J, *Textile Research J* **23**, 67 (1953).
(22) Makinson, K R, *Proc International Wool Textile Research Conference*, Vol E, Part 2, 460 (Australia 1955).
(23) Stock, C R, and Salley, D J, *Textile Research J* **19**, 41 (1949).

Southeastern, Northern New England, Washington, and Metropolitan Sections

MICROSCOPIC STUDIES WITH THE HIGH-TEMPERATURE (PRESSURIZED) MICRODYEOSCOPE*

HENRY E MILLSON
Organic Chemicals Div, American Cyanamid Co
Bound Brook, N J

The design and construction of a new instrument, a high-temperature (pressurized) Microdyeoscope is described. This instrument has a working range from 40°F to 325°F. Operational details are included and illustrated with photographs and drawings. Using this instrument, time-temperature studies have confirmed that the dyeing rates of the newer synthetic fibers are increased appreciably by dyeing at temperatures above 212°F. The diffusion of the dye into the fiber proceeds much more rapidly with all textile fibers in the temperature range 270°F to 300°F compared with the range 200°F to 212°F. The degrading action of various components of the dyebath or treating bath on wool, dyed chlorinated wool, rabbit hair, cotton, dyed viscose rayon, Orlon 42 and Dynel is described, and illustrated with photomicrographs.

The use of the high-temperature Microdyeoscope should be of value in further studies for understanding and preventing the decomposition of fibers during high-temperature treatments. This should be of real value to the dyer and to the manufacturer of the fiber. Work in this field is continuing in the laboratories of American Cyanamid Co.

INTRODUCTION

Changes which take place in dyes and fibers during high-temperature treatments are important not only to the dyer, but also to the manufacturer of the dyes, to the producer of the fiber, to the spinner, to the knitter or weaver, to the finisher of the fabric and to the ultimate purchaser of the finished textile material. The development of the high-temperature (pressurized) Microdyeoscope has made it possible to observe and study these changes of fibers in dye- and treating-baths at temperatures above 212°F.

The importance of temperature in the dyeing and processing of textile materials has been the subject of numerous investigations. F L Goodall (*1*), in his studies on wool dyeing, showed that improved results could be obtained by the use of a boiling dyebath. H J Walter (*2*) conceived the idea of dyeing piece goods rapidly and continuously at temperatures above 212°F. At 290°F, completely-dyed wool fibers can be obtained within 30-90 seconds with certain milling dyes, whereas at 200°F it may require one to two hours to obtain equal levelness, penetration, and depth of shade (*3*). Walter's concept resulted in the development of new equipment for dyeing at elevated temperatures and pressures. Following this development, the use of high temperatures and pressures for dyeing textiles has become practical and at present is a standard procedure in many dyehouses. However, satisfactory color reproducibility from batch to batch is not always obtained despite an appreciation of the necessity for control of certain conditions including temperature, time, pH, composition of the dyebath, and preparation of the material to be dyed.

The development of the new, more temperature-resistant synthetic hydrophobic fibers has further stimulated interest in high-temperature dyeing because these fibers often have extremely slow rates of dye adsorption and diffusion at or below 212°F.

The use of the Microdyeoscope (*4,5*) made it possible to observe closely, at temperatures up to 210°F, what occurred when a dye or a textile auxiliary met the fiber in the dyebath. As the Microdyeoscope had been designed to work at atmospheric pressure, however, it was not possible to use this instrument for the study of dyeings when the temperatures exceed 212°F. To remove this limitation, an instrument has been designed and constructed for high-temperature (pressurized) operation. Such an instrument can also be used to study the degrading effect of the dye- or treating-bath constituents on the fiber at elevated temperatures for varying periods of time.

The first part of this paper deals with the design and construction of the high-temperature (pressurized) Microdyeoscope. It has a working range from 40°F to 325°F, which requires pressures from 15 psi (atmospheric) to about 60 psi. The newly designed instrument has a Micro Ibso (Leitz) and a camera attachment which enables the viewer to record on film that which he observes visually. The operational details and several drawings and photographs are included in this section.

The second part of this paper describes some of the experimental work which has been completed to date. Time-temperature studies again have shown that the dyeing rates of the newer synthetics are increased appreciably by dyeing at temperatures above 212°F. Also, it has been found that diffusion of the dye into the fiber proceeds much more rapidly with all textile fibers in the temperature range 270°F to 300°F, compared with the range 200°F to 212°F. The action of water and certain chemical solutions encountered in the dyehouse on wool, chlorinated wool, rabbit hair, Orlon 42, Dynel, cotton and viscose rayon are discussed and illustrated with photomicrographs.

THE HIGH-TEMPERATURE (PRESSURIZED) MICRODYEOSCOPE

This Microdyeoscope shown in Figure 1 consists of a high-temperature (pressurized) unit and a focusing unit. On the focusing unit is mounted a lamp and a microscope with an attached Micro Ibso and camera. The high-temperature unit shown in Figures 2 and 3 is a self-contained noncirculating apparatus containing two sets of input reservoirs, A & B, each reservoir having a capacity of 245 ml and the contents of which can be used for dyeing, treating or rinsing baths. Control valves C & D in the outlet lines from reservoirs A & B, respectively, control the flow of liquors to an observation cell. The contents of the cell flow through drain tube E into a large drain reservoir located at the bottom of the unit. The reservoir is equipped with a drain valve and drain tube. The outlet of drain tube E is located at the top of the reservoir to prevent reverse flow. A pressure-equalizing tube is connected between the input reservoirs

*Presented before the following Sections of AATCC: Southeastern (September 22, 1956); Northern New England (October 18, 1956); Washington (December 3, 1957); and Metropolitan (February 7, 1958).

and the drain reservoir to equalize pressure throughout the system.

As shown in Figure 1, the input and drain reservoirs are enclosed in a rectangular jacket or pressure unit made of No. 316 stainless steel (molybdenum fortified). Sealed openings are provided on either side of the observation cell to a) permit the viewer to focus the microscope on the contents of the cell, and b) permit light to pass from the light source through the observation cell and into the optical system of the microscope. This pressure unit is filled with a pure mineral oil (Perma SAE 10), which is heated by means of a 2000-watt immersion coil located between a side of the unit and a baffle plate. The purpose of this baffle plate is to control the flow of the heated oil, which is circulated by heat-convection currents. This makes possible rapid and uniform heating of the system. The rate-of-temperature rise is controlled by a Variac (not shown) and is measured by two thermometers located at the side and top of the unit. These thermometers have a range 0°F to 400°F. The temperature of the oil is maintained by off-and-on contact with the power source through a thermostat (not shown). A pressure gauge (0-60 lbs) is located at the top of the unit. Filling cups F 1, F 2 and G, equipped with high-pressure valves F 3, F 4 and G 1, respectively, for adding solutions to the input reservoirs are positioned at the top of the unit. Cups F 1 and F 2 are constructed so that solutions can be added to the two input reservoirs (A) while the unit is under pressure. This requires several steps which must be taken in the following order: Valve F 4 is closed and valve F 3 is opened, filling cup F 2 is heated with an alcohol lamp or Bunsen burner, and valve F 3 is then closed. The solution to be added is placed in filling cup F 1 and filling cup F 2 is cooled with ice. Valve F 3 is then opened to permit the solution to pass from filling cup F 1 to filling cup F 2. Valve F 3 is then closed and valve F 4 is opened after which filling cup F 2 is heated until the solution it contains is forced into the input reservoirs (A), then valve F 4 is closed.

The focusing unit shown in Figure 1 had to be designed because the cell is an integral part of the high-pressure unit and cannot be moved separately as in the original Microdyeoscope. The lamp and the microscope, with its Micro Ibso and camera attachments, are mounted on the focusing unit to provide for their simultaneous movement in relation to the stationary observation cell. This focusing unit can be moved horizontally, diagonally or vertically as desired by manipulating five adjustment screws. During an experiment, any part or many parts of a fiber can be kept in focus for examination or photographing by means of the adjusting screws. Figure 4 is a schematic drawing (top view) of the focusing apparatus.

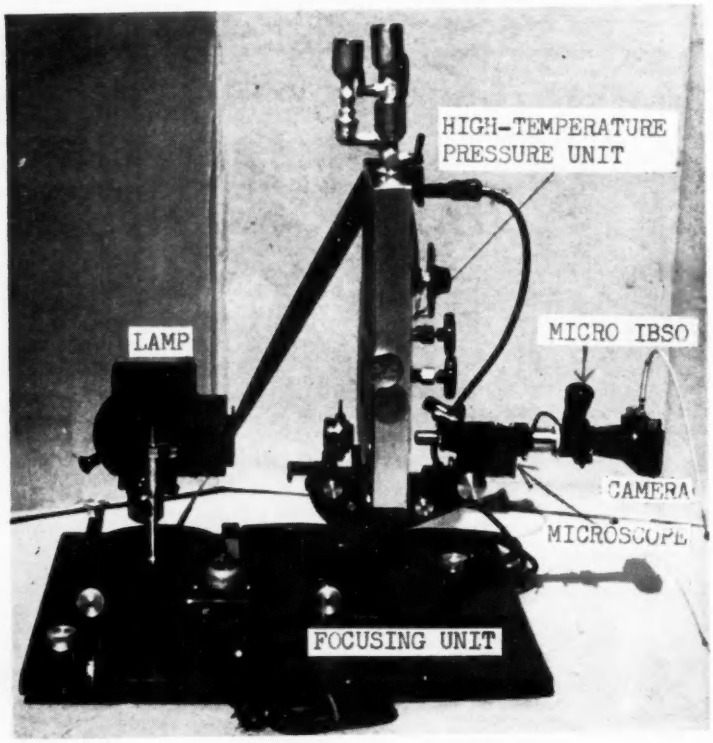


Figure 1
The assembled high-temperature (pressurized) Microdyeoscope.

Construction details of the cell are shown in Figure 5. The body of the cell is made from a piece of type-316 stainless steel (molybdenum fortified). It is cylindrical in form, and is fitted with windows on both flat faces. The rear window is a small disc of quartz or optical glass approximately 70/1000-inch thick. It is secured against a pure-gum rubber gasket by a bronze external retaining ring, which screws into the body of the cell. The front or observation window is made of quartz, is 35/1000-inch thick and one inch in diameter. It is also secured by a similar gasket and retaining ring, which are designed and fitted to permit the close approach of the microscope objective over the widest possible area of the window. The thickness of the cell, ie, the space between the inner faces of the two windows, is approximately 4 mm. Inlet and outlet ports around the periphery of the cell are attached to stainless-steel tubes connecting to the reservoirs. The cell is identical to the one used in the atmospheric-pressure Microdyeoscope (4,5) except it is soldered into the high-pressure unit and is not mounted on a microscope stage.

OPERATIONAL PROCEDURE ———Fibers selected for observation in the cell are mounted by winding on U-shaped frames formed from Nichrome Wire, size 0.015 inch. (See Figure 6). Each frame can carry up to ten fibers so that a number of fibers of the same type or different types can be kept under observation during an experiment.

The mounting of each fiber is accomplished by tying one end to the frame, attaching a small tensioning weight to the other end, winding the fiber onto the frame, and securing the free end of the fiber by a light coat of an adhesive material which is inert to the heat and chemicals to be used in the experiment. Cellulose acetate is a satisfactory cementing material for temperatures up to 212°F. Isobutyl methacrylate gives satisfactory results at elevated temperatures.

The frame containing the fibers is then cemented to a fiber-frame holder (Figure 7) made from a stain-

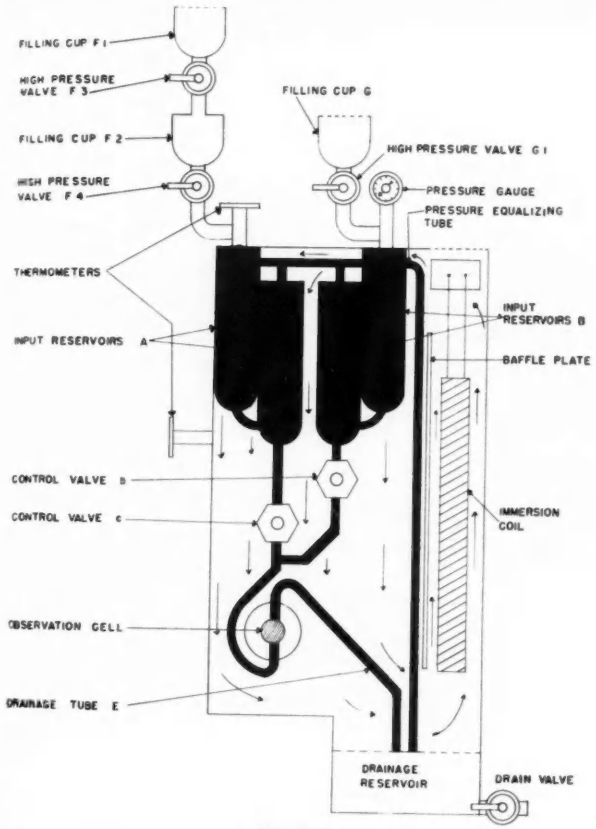


Figure 2
Schematic diagram of the high-temperature (pressurized) unit.

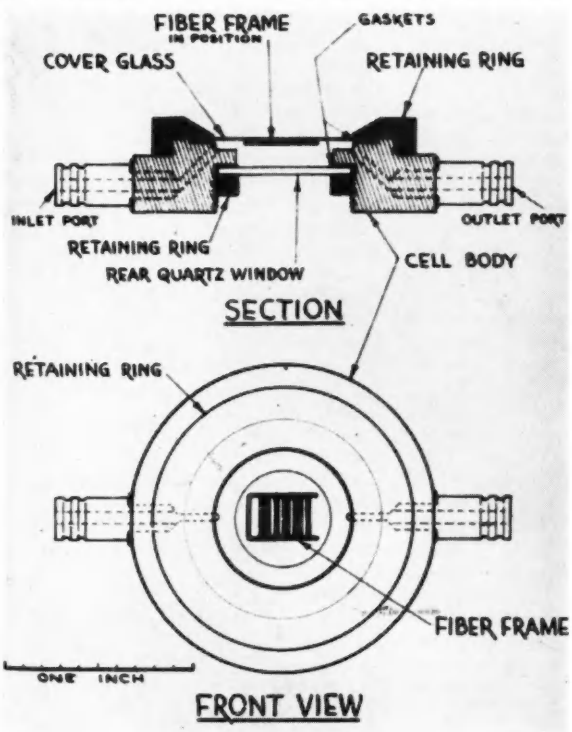


Figure 5
A schematic diagram of the Microdyeoscope cell.

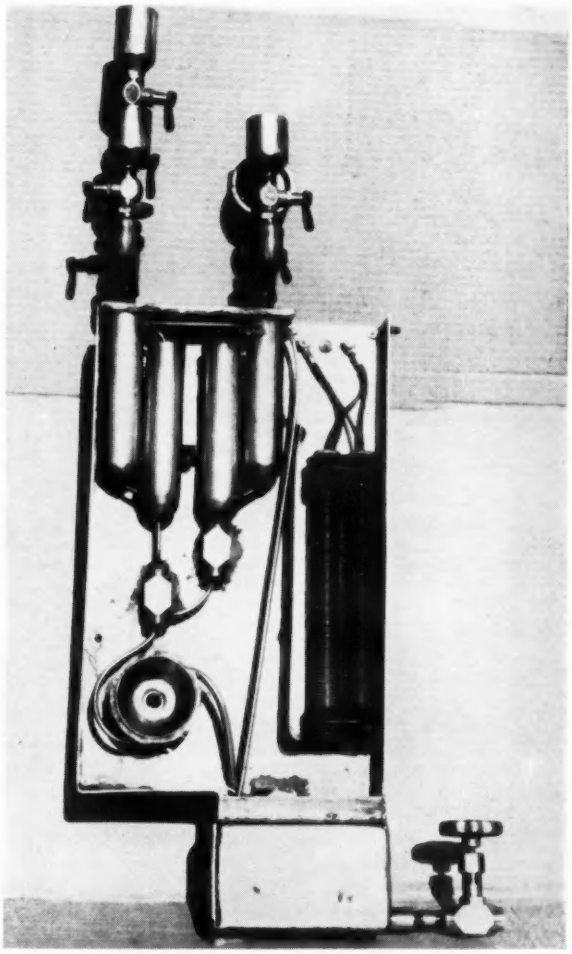


Figure 3
A photograph of the interior of the high-temperature (pressurized) unit.

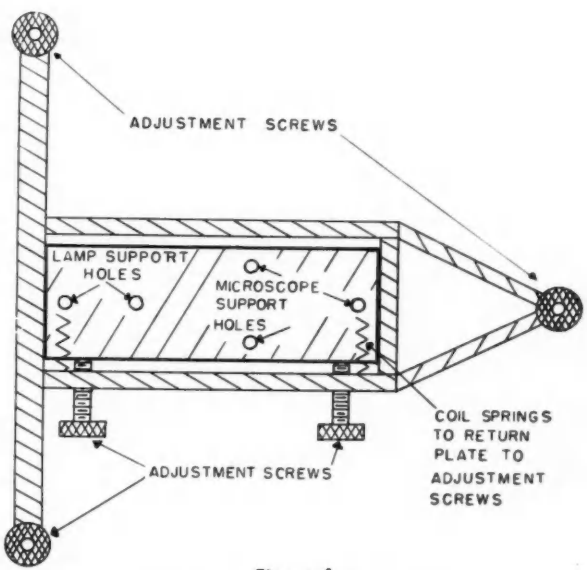


Figure 4
Schematic diagram of the focusing unit.

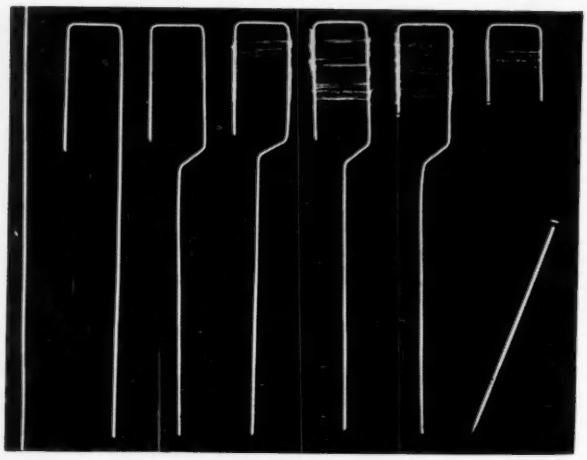


Figure 6

Preparation of frames and fibers for observation in cell. From left to right: length of wire of which frame is made; frame formed; frame handle made coaxial with frame for uniform winding; continuous filament of viscose rayon wound onto frame; variety of fibers wound on the same frame——these are, from top to bottom, viscose rayon, wool, nylon, Dynel, a Sea Island cotton fiber, Dacron, Orlon 42 and Acrilan; five wool fibers 60s quality, each about five inches long; three wool fibers tied together before winding and wound as a single fiber——following the fiber winding operation this frame has been cut to actual size required by the cell; a common one-inch straight pin shown for comparison.

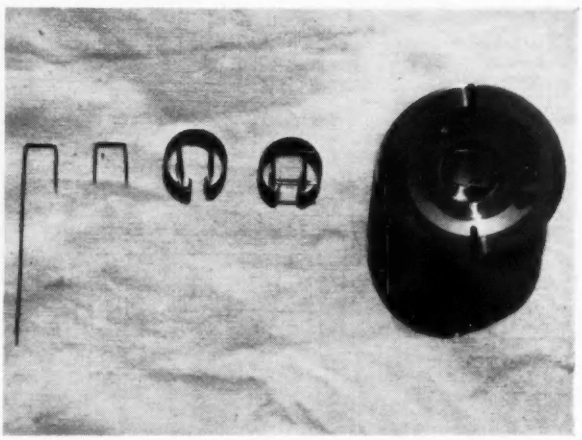


Figure 7

From left to right, this photograph shows a wire frame on which fibers have been wound, frame cut to actual size required for mounting in cell, the fiber-frame holder, fiber-frame holder with fiber frame cemented on stainless steel wire spring and frame assembly inserted in Microdyeoscope cell.

less-steel band and wire. A stainless-steel wire spring presses the fiber frame against the observation window, thus preventing slipping (Figure 7).

The fiber-frame holder is placed in the cell by removing the front window, squeezing the two ends of the frame holder together with tweezers, inserting the squeezed holder, and then removing the tweezers when the holder is in place. The rubber gasket, window and retaining ring are then replaced. The spring holds the fiber against the front window with the fibers located immediately behind the window within the focal length of the objective of the microscope. It is to be noted that during an experiment care must be exercised to avoid breaking the front window of the cell during manipulation of the objective.

THE EFFECT OF TEMPERATURE

Before describing the results of the experiments obtained with the high-temperature Microdyeoscope, it may be helpful to discuss briefly the nature of heat and its effects since temperature has a greater effect upon dyeing than any other single factor.

Temperature is the measure of relative heat and cold in a body, heat being defined as the energy of motion (kinetic energy) of molecules. As the temperature of a dyebath is raised, the motion of the molecules becomes more violent and they bump into other molecules with more force. Because of this increased bombardment, dye agglomerates, which may form at lower temperatures, tend to break up; fibers swell, making penetration of dye into the fiber more rapid; and diffusion speed and chemical reactivity increase. The net result of these changes is to promote more rapid and more level dyeing. Normally, with an open vessel, a temperature limit is reached at the boiling point of the dyebath. At this temperature, the internal pressure of the liquid equals one atmosphere and the addition of more heat serves only to convert water into steam without raising the temperature. By increasing the pressure on the dyebath, it can be kept liquid at temperatures well above 212°F. This increased pressure is obtained in the high-temperature Microdyeoscope or in a pressure-dyeing machine by hermetically sealing the system. When heat is then applied, the bath begins to boil at its normal boiling point, but as more of the liquid is converted into steam, the pressure and the boiling point of the bath both rise.

The increase in chemical reactivity with increasing temperature is simultaneously a help and a detriment in dyeing. It is a help since equilibrium between the dye and the fiber is rapidly attained, thus promoting leveling; it is a detriment because it shortens the time during which materials can be dyed safely without damage to the fiber or decomposition of the dye. The criticality of the pH of the dyebath increases with rising temperature and, in fact, a pH which can be tolerated by fibers and dyes for hours in the range 180°F to 212°F may quickly damage fibers or dyes at temperatures above 225°F.

When applied at temperatures in the range 150°F to 200°F, most dyes accumulate on the outer part of the fiber at a more rapid rate than the dye molecules can diffuse from the outer part into the interior of the fiber, and this causes ring dyeing (*15*). However, at elevated temperatures, the rates of deposition on, and diffusion into the fiber are more rapid and are more nearly equal. Therefore exhaustion of the dyebath and complete penetration of the dye into the fiber proceed very rapidly. Under such conditions a dyeing may be completed within a matter of seconds or minutes compared with the hours often required for a more conventional dyeing.

Dacron filament is quite difficult to dye and therefore is a useful fiber with which to illustrate the influence of temperature and time on the rate of absorption and diffusion of dyes. A series of macro dyeings on yarn was made to compare the rates of diffusion of a disperse dye applied at the boil and applied at 260°F. Five percent owf of Calcosyn Alizarine Sapphire 2GS (*CI* 61505) was used for each experiment. Individual dyeings were made by boiling contin-

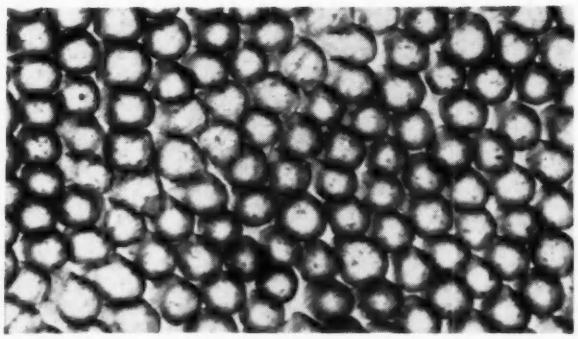


Figure 8
Cross-sectional view of Dacron filament fibers dyed with 5% Calcosyn Alizarine Sapphire 2GS Conc. Dyeing was boiled continuously for 10 hours.

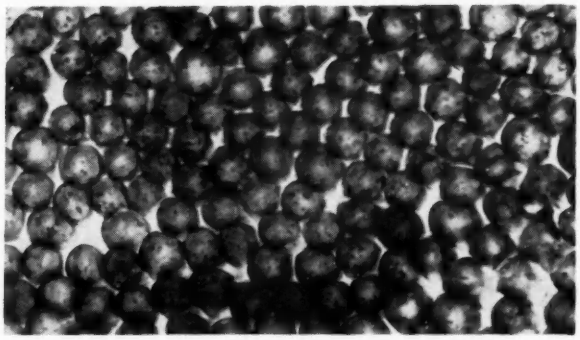


Figure 10
Cross-sectional view of Dacron filament fibers dyed with 5% Calcosyn Alizarine Sapphire 2GS Conc. Dyeing was boiled continuously for 48 hours.

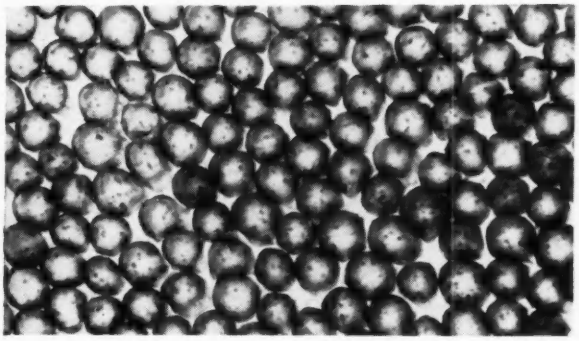


Figure 9
Cross-sectional view of Dacron filament fibers dyed with 5% Calcosyn Alizarine Sapphire 2GS Conc. Dyeing was boiled continuously for 24 hours.

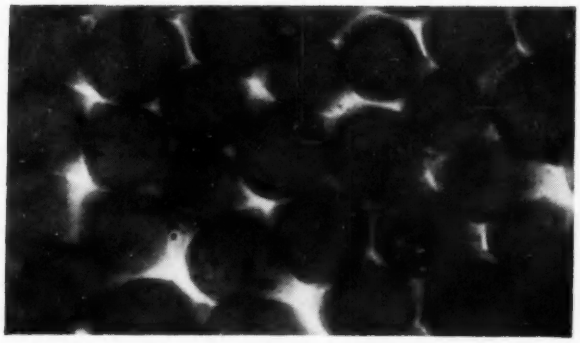


Figure 11
Cross-sectional view of Dacron filament fibers dyed with 5% Calcosyn Alizarine Sapphire 2GS Conc. Dyeing was run for 30 minutes at 260°F.

uously for 10, 24 and 48 hours and by dyeing for 30 minutes at 260°F without carrier or other additions to the dyebath.

Figures 8, 9 and 10 are cross sections of the 10-, 24-, and 48-hour dyeings respectively, and show that the diffusion of dye increases with the time of dyeing. The dyeing boiled 48 hours is far superior to the dyeing boiled only 10 hours. Figure 11 shows completely penetrated and uniformly dyed fibers when the Dacron is dyed for 30 minutes at an elevated temperature (260°F) without carrier. Thus, a better-penetrated dyeing is obtained at 260°F in only one ninety-sixth of the time required at 212°F.

EXPERIMENTS WITH THE HIGH-TEMPERATURE MICRODYEOSCOPE

The exploratory experiments made to date on various textile fibers emphasize the importance of controlling the temperature, duration of treatment, pH and the presence of additives in the bath when dyeing at high temperatures. A knowledge of the previous history of the textile material to be dyed is also important. For example, treatment with alkalis, acids, oxidizing or reducing agents and other degrading chemicals, prior to high-temperature dyeing, influence the results obtained.

Many of the experiments described in detail have been made at temperatures up to 300°F. Although a temperature of 300°F is higher than the temperatures in practical use at the present time, an increasing number of dyeing-machinery advertisements and articles on dyeing disclose the use of temperatures as high as 300°F (*6,7,8*).

Also, many of the experiments which have been made to study the degradation of fibers or dyes have been carried out in the range 270°F to 300°F, since in this temperature range much more rapid degradation occurs than at lower temperatures.

THERMAL DECOMPOSITION OF DYES——While water, which is used as the bath, is an extremely stable chemical and may be heated to 1000°F without appreciable decomposition, organic dyes when present are much less stable. Some dyes decompose to an insoluble black powder while other dyes change shade or are completely decolorized at high temperatures. The acidity or alkalinity of the dyebath affects the rate of decomposition of many cationic, direct, and wool dyes.

Experiments have shown that a rather large number of dyes are temperature-sensitive within the range 150°F to 212°F. Examples of such dyes are found in many types, including vats, cationics, acids, milling, acetates, and especially the directs (*11*). The number of dyes affected and the extent of degradation become greater with increase in pH and temperature. Thus, many dyes are unsuited for high-temperature application because of their sensitivity to pH and to thermal degradation, and unfortunately some of the more recently developed dyes are so affected.

The present art has not advanced to the extent that dyebath additives can be chosen in advance to retard or inhibit the degradation of dyes or textile fibers under high-tempera-

ture conditions. It is known, however, that at higher temperatures, chemicals such as sodium nitrite, alkali chlorates, and certain nitrogen compounds will retard the degradation of many vat dyes (*12*), and certain additives to direct-dye baths will prevent or retard the decomposition of many direct dyes (*11*). It is seen, therefore, that research on additives for high-temperature dyeing is a fertile field for investigation, and this project is being continued.

There is a particular need for protecting agents for the new cationic type basic dyes used for coloring acrylic fibers since many of these dyes exhibit a greater sensitivity to decomposition than most other types. Buffering the bath with sodium acetate increases the resistance of this type of dye to degradation, but does not entirely solve the problem; this is especially true when considerable time at the high temperature is required for the necessary diffusion of the dye into the fiber to obtain the development of the color value required for deep shades.

A study was made of the thermal degradation of the basic dye, New Blue R (*CI* 51175), at temperatures up to 250°F in the presence and absence of sodium acetate, but without the acrylic fiber being present. Two hundred fifty mg of dye were dissolved in 500 ml of distilled water (0.05% solution). One half of this solution was buffered with an addition of 200 mg acetic acid, 28%, and 30 mg sodium acetate. These amounts are equal to two percent and 0.3%, respectively, when based upon 10 grams of acrylic fiber. The other half of the dye solution received only an addition of 200 ml acetic acid, 28%. Table I shows the effect of time, temperature, and buffer on the stability of New Blue R.

TABLE I

Temperature (°F)	Elapsed time (minutes)	Color of buffered dye solution—2.0% acetic acid, 28%; 0.3% sodium acetate	Color of unbuffered dye solution—2.0% acetic acid, 28%
100	5	deep navy blue	deep navy blue
250	30	dull orchid	deep bluish red
250	40	light orchid	light yellowish red
250	50	very light orange	very light yellowish red
250	60	very light orange	colorless

TEMPERATURE EFFECTS ON WOOL———Animal fibers swell when treated in aqueous baths at temperatures in the range 180°F to 212°F. This type of swelling opens the fiber structure, and does little if any permanent damage to the fiber since the change is generally reversible. Some swelling is desirable because it enables the dye to enter the fine intermicellar spaces in the fiber, thereby increasing the rate of diffusion.

It is known that, during high-temperature treatments of wool in aqueous baths, certain physical changes occur, such as swelling; at the same time, the distal edges of the scales are raised and extended outwards from the surface of the fiber. This phenomenon has been shown previously to facilitate the absorption and diffusion of dye into the wool fiber (*16*). It is known that drastic treatment of wool with acids or alkalis at elevated temperatures causes chemical degradation, probably through the breaking of many of the disulfide bonds, resulting in the liberation of hydrogen sulfide, which can be detected by chemical test. This rupturing of disulfide bonds is probably largely responsible for the loss of tensile strength, change in elasticity, and discoloration of the fiber, which accompany degradation. Even prolonged boiling of wool in water causes degradation of the wool with the formation of hydrogen sulfide and other reducing substances, which may attack dyes present in the bath, resulting in off shades or decolorization. The Sulfon Cyanines, (*CI* 26360, 26400) for example, exhibit this sensitivity to reduction and change from blue to brown unless an addition of sodium- or potassium-bichromate, or other oxidizing agent, is added to the dyebath at the start of the dyeing cycle (*10*).

During this investigation, it was observed in macro experiments that wool flannel treated in distilled water at various temperatures was degraded, and chemical tests proved that rupturing of disulfide bonds occured at temperatures ranging between 212°F and 300°F. Experiments showed that higher temperatures and longer treatments caused larger numbers of the disulfide bonds to be ruptured and that the wool flannel turned brownish under protracted treatment at elevated temperatures.

It has also been observed that prolonged treatment of wool in aqueous baths at elevated temperatures causes general degradation and obliteration of the scale structure, resulting in severe tendering of the fiber. Based on these observations, it is apparent that there is need for dyebath additives which can act as protective agents for the wool during processing, and this work is being continued in this laboratory. Several compounds including formaldehyde have already been investigated, and it was observed that, while all of them had some effect for short periods of time, their effectiveness decreased with rise in temperature or increase in the time of the treatment.

STABILITY OF WOOL IN DISTILLED WATER———A series of experiments was made using wool flannel, which, prior to use, had been immersed for twelve hours at room temperature in a potassium dihydrogen phosphate-caustic soda solution buffered at pH 7. The results of these experiments are tabulated in Table II and these data show the relationship between time, temperature and the degree of degradation.

EFFECT OF TREATING DYED WOOL AT 290°F———All boiling treatments to which wool is subjected during dyeing have an adverse effect upon the fiber. The extent of the adverse effect depends upon the temperature, time, pH of the dyebath, and the previous history of

TABLE II
EFFECT OF TEMPERATURE ON WOOL
Treated in distilled water only at pH 6.5. Liquor ratio: 30:1

Temperature and duration of treatment	Appearance of wool compared to control	Appearance of treating bath	Ending pH of treating bath	Presence of hydrogen sulfide in bath	Odor of hydrogen sulfide in fabric	Tensile strength of wool	Shrinkage of fabric
At 50°F for 30 min	sl yellower	clear	6.5	none	none	normal	none
At 150°F for 30 min	sl yellower	clear	6.7	none	none	normal	none
At 212°F for 30 min	yellower	sl cloudy	6.9	definite test	none	normal	very slight
At 260°F for 30 min	much yellower	cloudy, yellow, turbid	6.5	considerable	strong	weak	considerable
At 260°F for 60 min	light tan	cloudy, yellow, turbid	6.4	large amount	strong	very weak	great
At 260°F for 120 min	darker tan	cloudy quite yellow and turbid	6.1	very large amount	strong	very weak	great

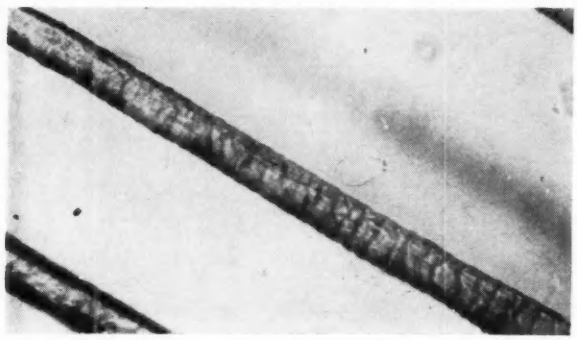


Figure 12
Blue-dyed Australian wool fiber in distilled water at 140°F.
Dyed previously with
3% metalized blue dye
10% sulfuric acid.
Boiled 2 hours.

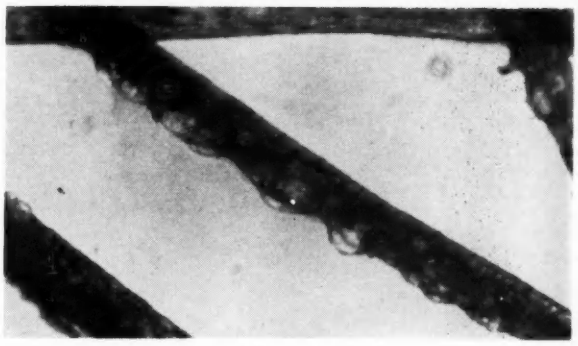


Figure 14
Blue-dyed Australian wool fiber at 295°F after one hour and fifty-seven minutes the fiber was covered with colorless sacs or blisters.

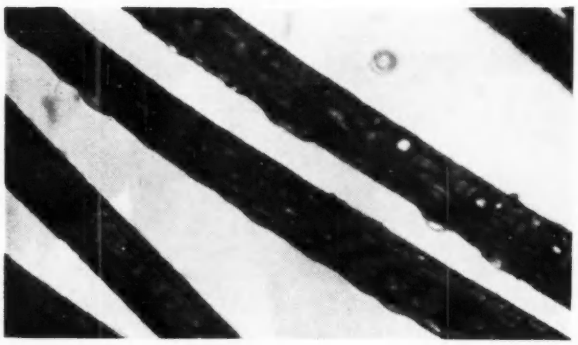


Figure 13
Blue-dyed Australian wool fiber at 295°F, after one hour and forty-two minutes fibers became darker and colorless sacs or blisters appeared.

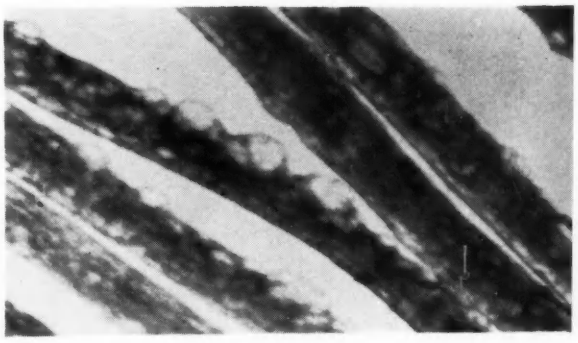


Figure 15
Blue-dyed Australian wool fiber at 295°F after two hours and twenty minutes showing enlargement of the numerous sacs or blisters.

the wool itself. For example, wool loses considerable tensile strength when it is redyed after first being dyed with acid-insensitive metalized dyes, such as the Calcofast, Neolan, and Palatine dyes, which are generally applied at a low pH because of the high concentrations of sulfuric acid required for leveling.

Earlier examination in the original Microdyeoscope had shown that wool was damaged when dyed under normal dyeing conditions with 3% of a metalized blue dye. Consequently, it was believed that this blue-dyed wool would be excellent material to study when further exposed to liquids at high temperatures. Changes in the fiber which should be visible in the high-temperature Microdyeoscope might help to explain the "nature" of wool damage and perhaps reveal hitherto unknown features of the wool-fiber structure.

In this experiment, the dyed fibers were treated in distilled water only. Figure 12 shows the fiber in water at 140°F. The fiber was blue in color and the scale structure was well defined. The temperature was then raised slowly to 295°F, and after a total elapsed time of one hour and forty-two minutes the fibers had changed to a brownish-blue shade and had swollen considerably. Surprisingly, colorless sacs or blisters had formed on the surface of these fibers, as shown in Figure 13. After a total elapsed time of one hour and fifty-seven minutes the surface of the fiber was covered with colorless blisters which appeared to be independent of the scale surface. (Figure 14). After a total elapsed time of two hours and twenty minutes the blisters had increased in size, had become more numerous and the fiber was observed to be more plastic in nature. (Figure 15). Shortly after this photograph was taken, the fibers elongated to such an extent that it was not possible to bring the fiber into focus, and the experiment was discontinued.

In another experiment, Australian wool fibers, which had been dyed previously with 2% Calcofast Wool Pink N (*CI* 18810) using 10% sulfuric acid and boiling for 35 minutes, was treated in 0.4% sulfuric acid solution. As shown in Figure 16, the fibers at 150°F were pink in shade and had sharp and unimpaired scale structures. When the temperature had reached 212°F, the fibers had swollen very slightly and their scale structure was still well defined. At 270°F, twenty minutes after the start of the experiment, the fibers had swollen approximately 10% and the scale structure was less distinct. At 300°F and an elapsed time of 41 minutes, the fiber had swollen approximately 20% and the scale structure was much less distinct. After 25 minutes at 300°F, the scale structure was much less distinct and the surface of the fiber exhibited a fuzzy appearance as though the scales were beginning to slough off. After 45 minutes at 300°F, the diameter of the fiber had increased 30%, the color had been leached out, and the scale structure had been obliterated as shown in Figure 17.

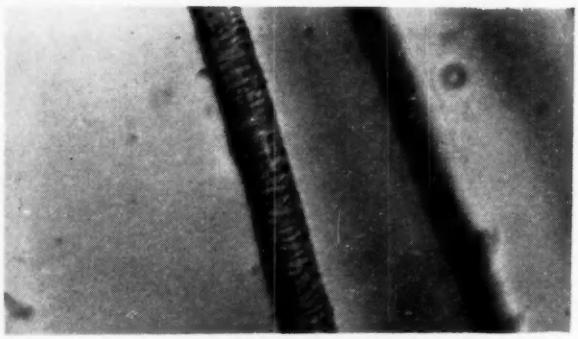


Figure 16
Australian wool fiber in a 0.4% sulfuric acid solution at 150°F.
Dyed previously with
2% Calcofast Wool Pink N
10% sulfuric acid.
Boiled 35 minutes.

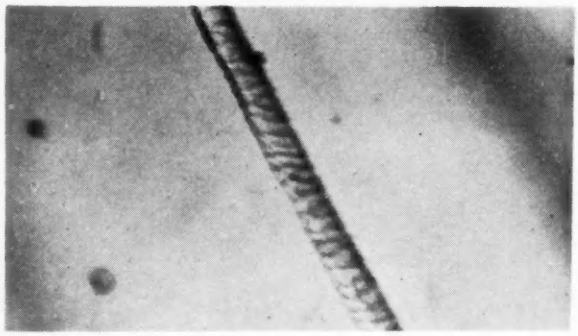


Figure 18
Australian fleece wool fiber in an 0.05% caustic soda (NaOH) solution at 50°F. Note sharp scale-structure.

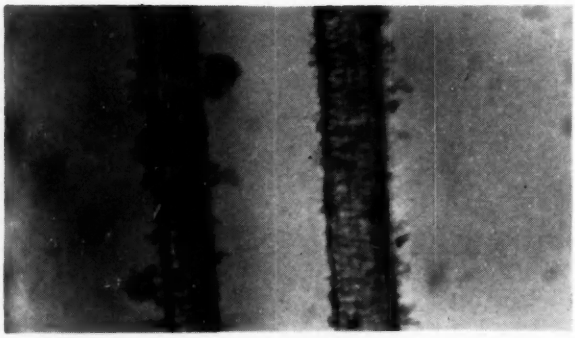


Figure 17
Pink-dyed Australian wool fiber after 45 minutes at 300°F in 0.4% sulfuric acid solution. The fiber is swollen and the scale structure obliterated.

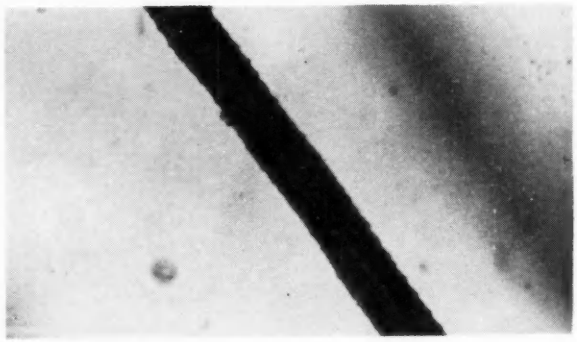


Figure 19
Australian fleece wool fiber at 250°F. Elapsed time 30 minutes. Fiber has swollen and turned brownish.

EFFECT OF ALKALIS ON WOOL AT HIGH TEMPERATURE

Wool is somewhat sensitive to alkali at low temperatures, and this sensitivity increases with rise in temperature. Alkaline baths appear to be the most damaging at elevated temperatures to all of the different fibers studied and therefore pH control of the dye- or treating-bath is extremely important. Whenever possible, alkaline baths or baths containing alkaline salts should be avoided, and this is especially true for wool which requires a bath below pH 7 to mimimize fiber degradation.

There are a number of ways in which undesirable alkalis can enter the dye or treating bath. The dyes themselves are potential sources as they may contain soda ash of other alkaline salt which has been added to improve the solubility and working properties of the dye. Steam may be a source of alkali when boiler compounds containing free caustic soda, soda ash, or sodium silicate are used to inhibit scale formation. Alkali and alkaline-reacting salts are often added to dyebaths to promote levelness and retard the rate of dye absorption. Detergents and surface-active agents may also contain alkali and should be tested carefully for its presence before use in high-temperature dyebaths. Also, a considerable proportion of the wool used at present by the industry will have been scoured with soap and an alkali carbonate, residual amounts of which can cause a dyebath to have a pH ranging between 7.5 and 9. It is advisable to check the pH of the dyebath prior to the start of the operation and to adjust the bath to a pH below seven by the addition of ammonium sulfate, ammonium acetate or acetic acid.

A Microdyeoscopic study was made on an Australian fleece wool at elevated temperatures to show the effect of a low concentration of alkali. The treating bath consisted of an 0.05% solution of caustic soda. Figure 18 shows the appearance of the fiber and scale structure at 50°F. The temperature of the bath was raised slowly to 250°F, during which time the fiber swelled considerably and became brownish in shade. The scale structure was still visible and the distal edges were enlarged after a total elapsed time of 30 minutes as shown in Figure 19. Between 250°F and 270°F and an elapsed time of 46 minutes, swelling was observed, the fiber softened, and the scale structure was obliterated (Figure 20). After a total elapsed time of 57 minutes and at a temperature of 270°F, further disintegration had occurred. The outer surface of the fiber was corrugated and gelatinization was progressing rapidly, as shown in Figure 21. The temperature was then raised to 280° F and run five minutes, during which time further swelling and extreme gelatinization occurred. Figure 22 shows the fiber after a total elapsed time of one hour and five minutes. Similar results were obtained with caustic potash as expected.

TREATMENT OF CHLORINATED WOOL——The chlorination of wool results in a chemical reaction which

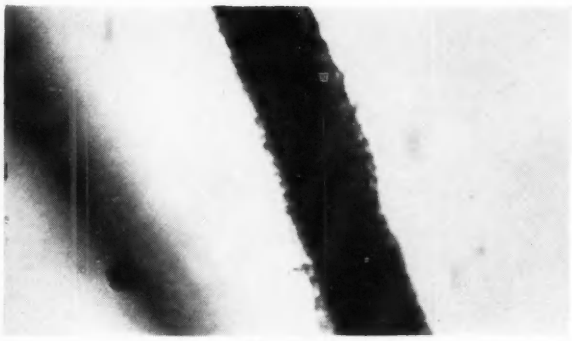


Figure 20
Australian fleece wool fiber at 270°F. Elapsed time 46 minutes. Fiber had swollen, softened and the scale structure was obliterated.

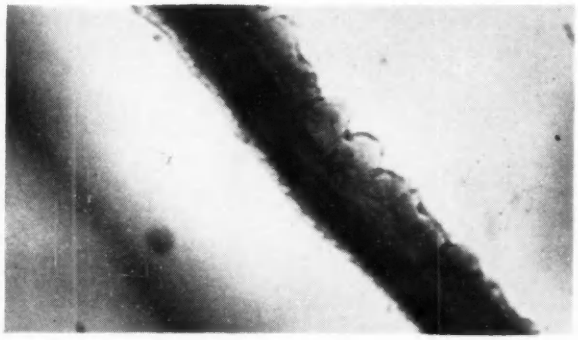


Figure 21
Australian fleece wool fiber at 270°F. Elapsed time 57 minutes. Fiber has swollen and gelatinized.

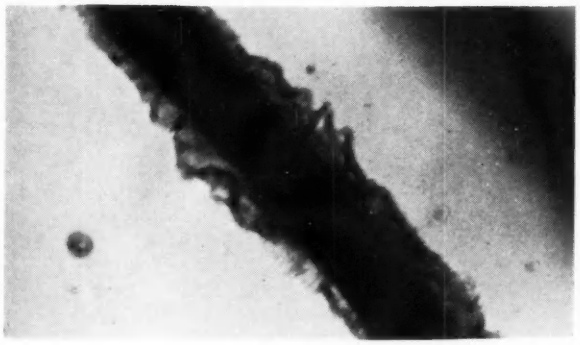


Figure 22
Australian fleece wool fiber at 280°F. Elapsed time one hour and five minutes. Showing extreme swelling and gelatinization.

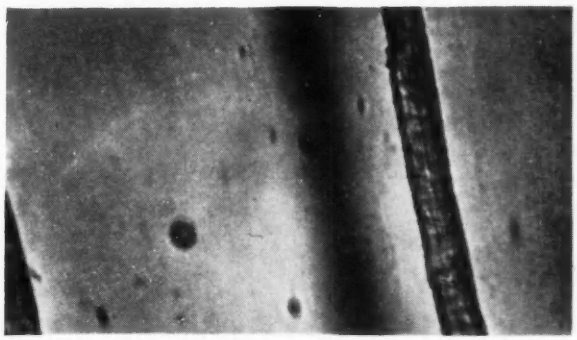


Figure 23
Chlorinated Australian wool fiber in distilled water at 212°F.

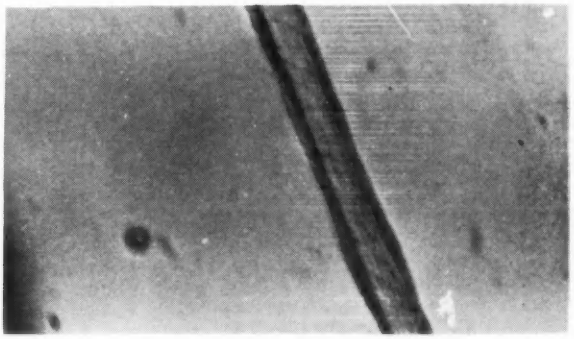


Figure 24
Chlorinated Australian wool fiber in distilled water at 250°F. A membrane is visible on left side of fiber.

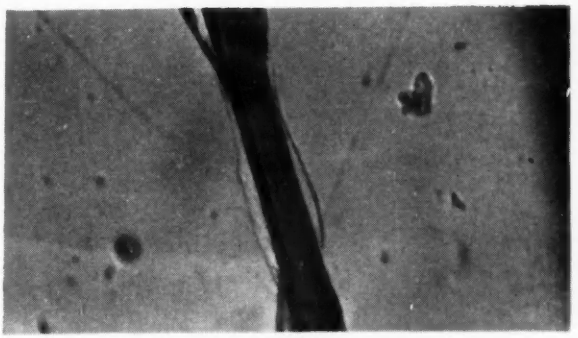


Figure 25
Chlorinated Australian wool fiber in distilled water at 260°F. Elapsed time above 212°F was 30 minutes. Note the separation of a continuous membrane surrounding the fiber.

takes place very rapidly, the first point of attack being the distal edges of the scales (*16*). As the duration of treatment increases, the chlorine attacks other areas until all sections of the fiber have been chlorinated. During treatment with an acid hypochlorite solution, Allwoerden sacs form, which develop into a continuous membrane when the chlorinated wool is thereafter treated with a dilute solution of caustic soda (*4*).

When chlorinated wool fibers are treated in distilled water at temperatures above 212°F, the fibers swell and a continuous membrance or tubule appears and envelops the more resistant portion of the cortex. This membrane appears to be similar to that which is formed when the Allwoerden sacs on chlorinated wool are treated with dilute caustic soda solution. The membrane formed on each of several different acid-chlorinated wool fibers when they were treated at a high temperature and, therefore, it was a common occurrence and not limited to an occasional fiber. However, the time and temperature at which the membrane formed varied with the individual wool fiber. The following detailed description of the formation of the membrane may be of interest. There was no membrane visible at 212°F. (Figure 23). When the temperature had reached 250°F, the membrane was distinctly visible on one side of the fiber. (Figure 24). At 260°F, after a total elapsed time of 30 minutes at temperatures above 212°F, a membrane enveloped the fiber. A careful visual examination of

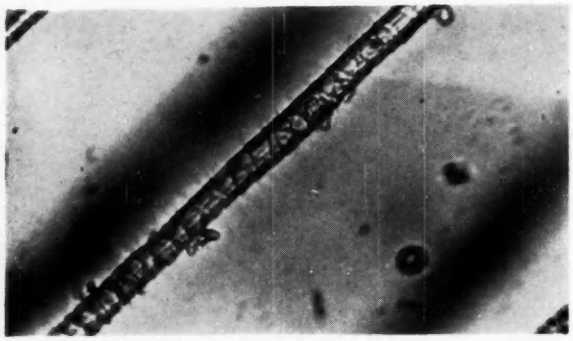


Figure 26
Chlorinated Australian wool fiber in distilled water at 212°F. Note sharp scale structure.

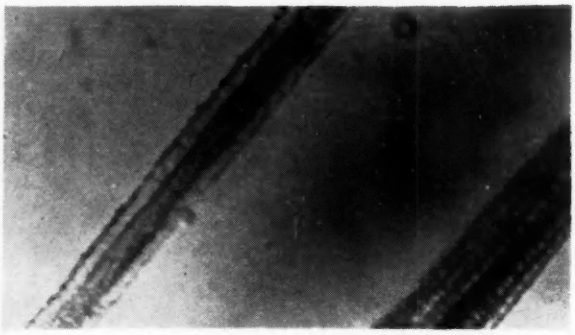


Figure 29
Chlorinated Australian wool fiber in distilled water after 30 minutes at 290°F. Note the sheath enveloping the fiber.

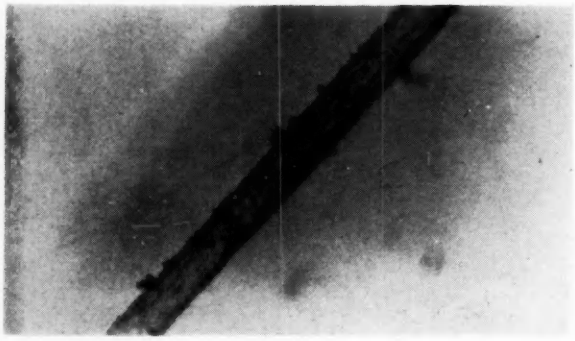


Figure 27
Chlorinated Australian wool fiber in distilled water at 260°F. Fiber was swollen and the scale structure obliterated.

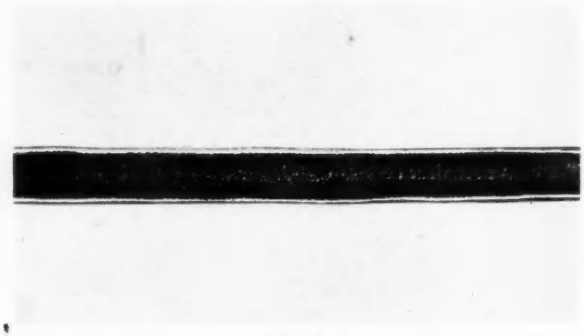


Figure 30
Body section of a rabbit hair mounted to show medulation and the surrounding cuticular sheath.

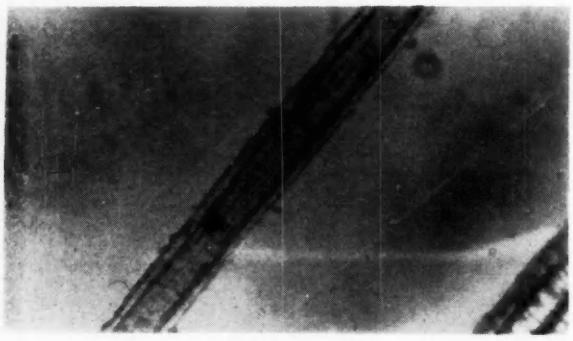


Figure 28
Chlorinated Australian wool fiber in distilled water at 285°F. Elapsed time one hour and twenty-five minutes. Note two distinct areas of fiber.

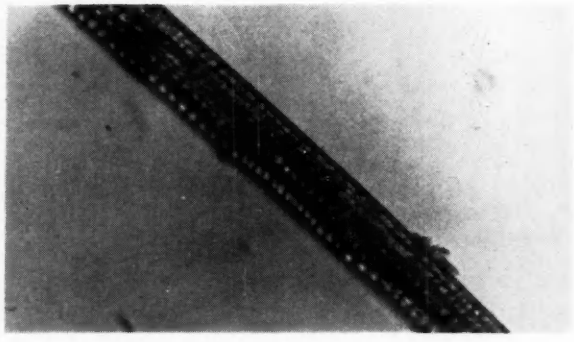


Figure 31
Rabbit hair in distilled water at 70°F.

the outer surface of the membrane revealed lines and edges similar to scales, which seemed to indicate that the membrane had been in contact with, or was associated with, the scale structure. (Figure 25).

In a similar experiment with another chlorinated wool fiber, a somewhat different effect was obtained after prolonged treatment in distilled water at elevated temperatures. It appeared in this experiment as though a portion of the fiber had dissolved, leaving the cuticular sheath enveloping the more resistant cortex. Figure 26 shows the fiber at 212°F with a sharp scale structure. The temperature was then raised slowly to 260°F, and the photograph shown in Figure 27 was taken. The fiber now had swollen, and showed severe damage and obliteration of the scale structure. When the temperature was raised from 260°F to 285°F, and after a total elapsed time of 85 minutes, the fiber had changed, now showing two distinct areas. (Figure 28). After an additional 30 minutes at 290°F, the fibers showed further swelling and enlargement of the enveloping sheath, as can be seen in Figure 29.

SWELLING OF RABBIT HAIR ——The treatment of a rabbit hair in distilled water at high temperature provided information on the structure of the hair and revealed details which

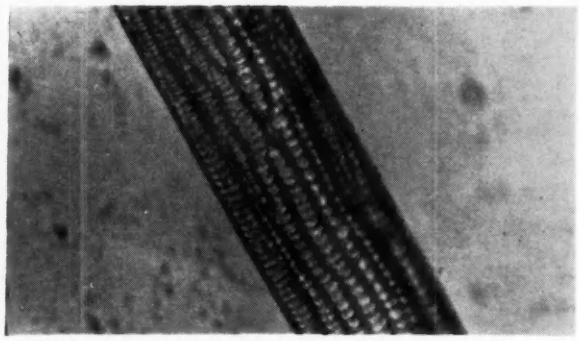


Figure 32
Rabbit hair in distilled water at 300°F. Total elapsed time 30 minutes. Note swelling and intimate details of the fiber structure.

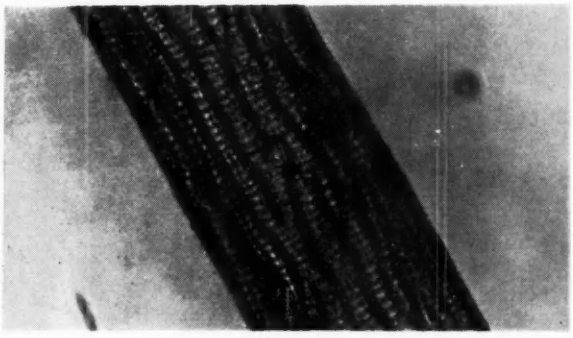


Figure 33
Rabbit hair in distilled water at 300°F. Total elapsed time 32 minutes. Compare Figures 32 and 33 and note the increase in fiber diameter which occurred within two minutes.

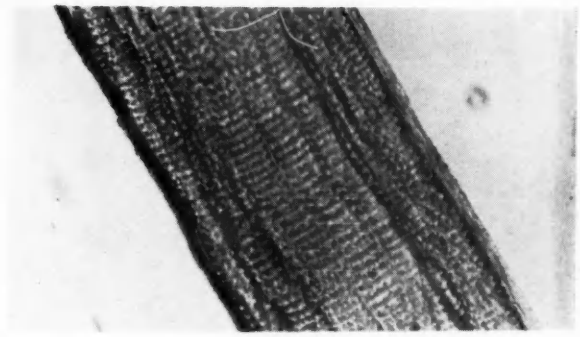


Figure 34
Rabbit hair in distilled water at 300°F. Total elapsed time 46 minutes.

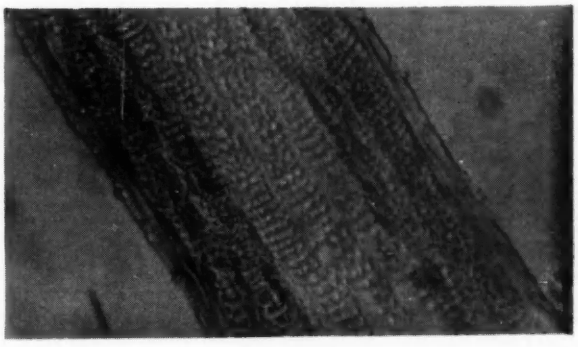


Figure 35
Rabbit hair in distilled water at 300°F. Total elapsed time 48 minutes.

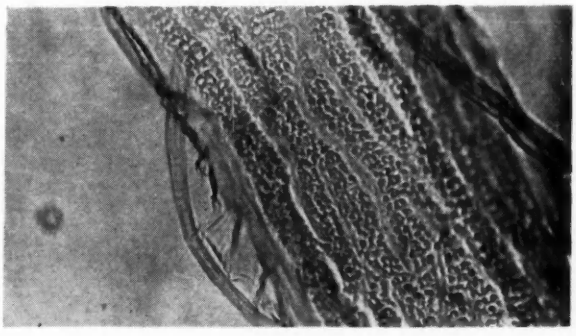


Figure 36
Rabbit hair in distilled water at 300°F. Total elapsed time one hour and thirty minutes. Note the separation of the cuticular sheath and its curled edges.

had not been observed in original microdyeoscopic studies conducted at 212°F. The hair selected for this study was taken from a piece of white hatfelt. The tip of the hair had a single medulla, which gradually increased in width until, at the body section, it showed quadruple medulation. (Figure 30). Viewed through the microscope, the medulated body section appeared black and represented most of the hair diameter. There was a narrow, colorless, transparent cuticular-sheath surrounding the medulated area. Figure 31 shows the hair as it appeared in distilled water at 70°F. Figure 32 shows the same area when the temperature had been raised to 300°F over a period of 30 minutes. The hair had swollen considerably, revealing the intimate details of its structure. Once it had started, swelling proceeded so rapidly that it was difficult to manipulate the focusing apparatus and the camera rapidly enough to obtain a sequence of photographs showing the phenomenal changes as they occurred. Figure 33 shows the hair only two minutes later at 300°F when swelling had increased the diameter to 2.4 times its original size. Figure 34, taken 14 minutes later at 300°F, shows an increase in diameter of nearly five times its original size. The interior areas of the hair had swollen and separated to such a degree that they produced a spectrum of color at each section in a manner similar to that of a diffraction grating. The whole hair exhibited the phenomenon of iridescence. Figure 35 was taken two minutes later and shows that the swelling continued. Figure 36, photographed at 300°F thirty-two minutes later and after a total elapsed time of one hour and twenty minutes, shows the swollen hair with the intimate details of structure and the cuticular sheath which now is separated and folded over the surface of the fiber. This structure was three dimensional when viewed through the Micro Ibso, but appears flat in the photograph. During this entire experiment the fiber was in constant motion; swelling, twisting, and writhing, and when the

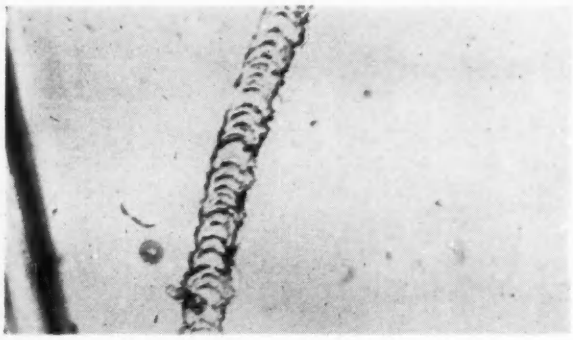


Figure 37
Image of a wool fiber etched upon the quartz window of the Microdyeoscope during treatment of wool at elevated temperatures.

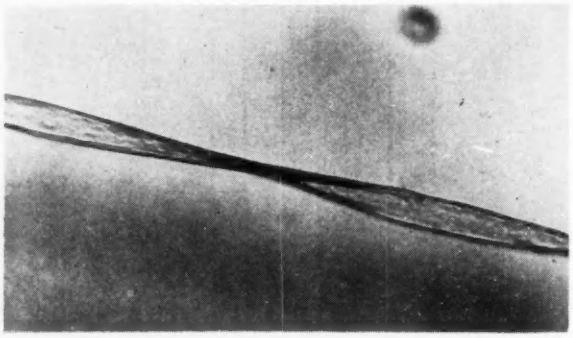


Figure 38
Cotton fiber in distilled water at 100°F. Prior to use in this experiment the fiber was dyed with

2% Calcodur Brown 4RL
10% common salt
Boiled one hour

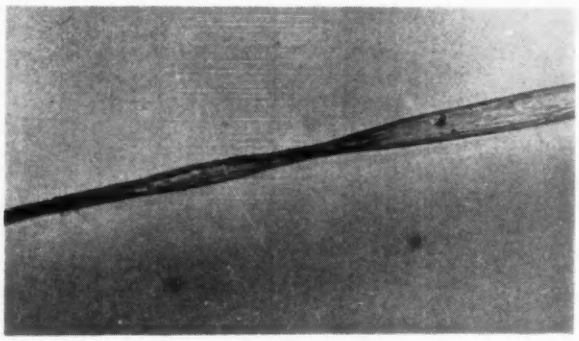


Figure 39
Brown-dyed cotton fiber in distilled water after 19 minutes at 250°F. Note twisted area in fiber.

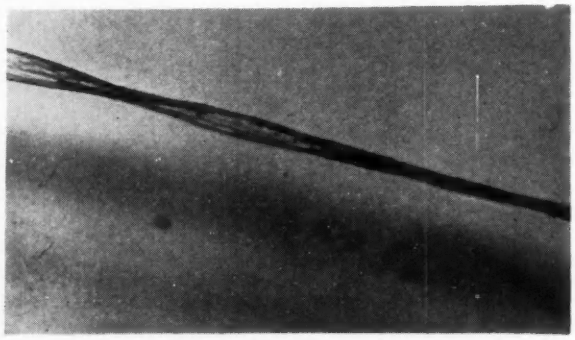


Figure 40
Brown-dyed cotton fiber in distilled water at 280°F.

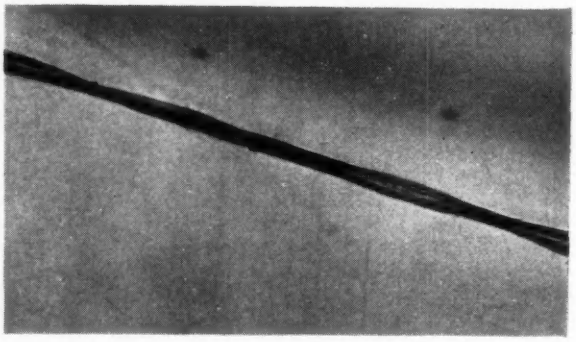


Figure 41
Brown-dyed cotton fiber in distilled water at 300°F; elapsed time 55 minutes. Note broad bands shown in Figure 34 have disappeared due to twisting of the fiber.

cuticular sheath finally sloughed off, it folded over or twisted around the surface of the fiber.

ETCHING OF QUARTZ WINDOW BY WOOL FIBERS——High-temperature treatments of wool fibers produced an effect not observed with the low-temperature Microdyeoscope, ie, contact images of the wool fibers were etched on the inside surface of the front quartz window at the point of fiber contact. These images were etched so deeply that subsequent polishing of the quartz window with jewelers rouge failed to remove them. These etchings occured during treatments of wool fibers which had been dyed previously with metalized dyes using sulfuric acid. Figure 37 shows the etched image of a wool fiber including the outline of Allwoerden-like sacs. No adequate explanation of this phenomenon is at hand.

TREATMENT OF COTTON FIBERS——The kier boiling of cotton under a few pounds pressure (ie, up to five pounds) to speed up the rate of removal of the natural pectins and waxes is old in the art of cotton processing. A study was made to determine the effect of high-temperature treatments on cotton fibers. Cotton proved to be an interesting fiber to watch during treatment in water at elevated temperatures because of a rotational movement of the fiber about its axis. These rotations caused a contraction of the fiber in the convoluted areas. Twisting and unwinding of the fiber appeared to occur at irregular intervals and was not rhythmic. The edges of the flatter areas of the fiber appeared to swell with increase in time and temperature. No two fibers were identical as to physical appearance or contortional movements since all exhibited a nonuniformity of distance between the convoluted and broader areas. The swelling and contortions varied along different parts of the same fiber.

Cotton fibers dyed previously with two percent *CI* Direct Red 94

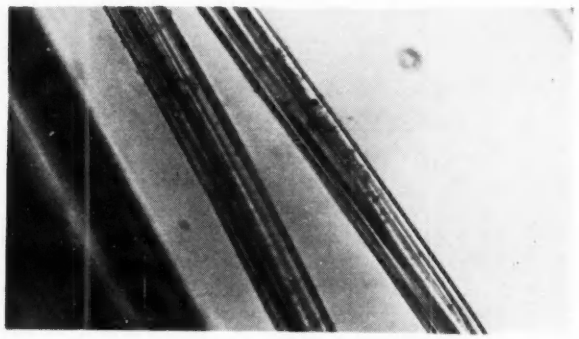


Figure 42
Viscose rayon fiber in distilled water at 60°F. Fiber had been dyed previously with
1% Direct Red 94
10% common salt
Boiled one hour

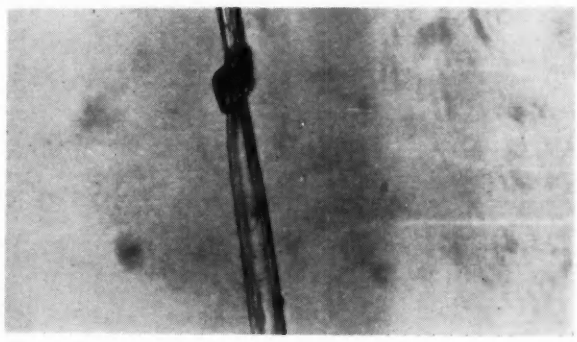


Figure 44
Dynel fiber in distilled water at 100°F. Knot was tied in fiber to assist in locating and photographing the same area.

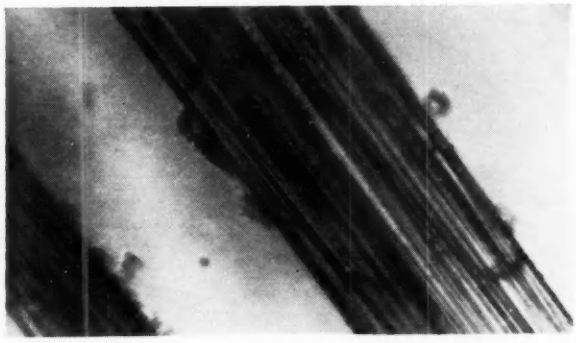


Figure 43
Brown-dyed viscose rayon fiber in distilled water at 300°F for 36 minutes. Note excessive swelling of this dyed fiber.

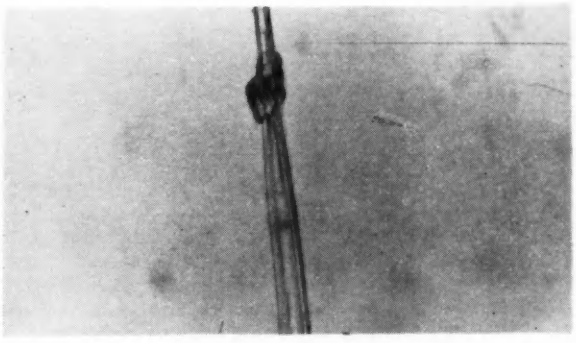


Figure 45
Dynel fiber in distilled water at 225°F. Total elapsed time 20 minutes. Fiber has shrunk due to treatment.

and 10% common salt were used in the following experiment. The fibers were treated in distilled water only and at the start a convoluted area in one cotton fiber was selected and photographed repeatedly as the time of treatment progressed. Figure 38, taken at 100°F, shows the convoluted area in the center of two broad areas. The same section at 250°F after 19 minutes shows one broad area so twisted that very little of it remains. (Figure 39). Figure 40 shows further twisting of the fiber in the same area at 280°F. Further twisting and winding were observed while the temperature was raised slowly from 280°F to 300°F. During this period, the fiber twisted to such an extent that little of the lower broad area remained after 55 minutes. (Figure 41).

DYED VISCOSE RAYON TREATED IN DISTILLED WATER ——There has been conjecture as to whether viscose rayon swells or shrinks at temperatures above 212°F. Experiments with the high-temperature Microdyeoscope indicate that the fiber is quite stable up to 250°F in distilled water but swells measurably in the range 250°F to 300°F. Variations in behavior between different viscose rayons were observed under high temperature conditions, probably due to differences in their fine structures.

In one experiment, viscose rayon showed very little change in diameter between 110°F and 250°F. When the temperature was raised slowly to 300°F, the diameter of the fiber increased only slightly. In another experiment using a viscose-rayon filament, which had been dyed previously with Direct Red 94, the fiber diameter doubled between 60°F and 300°F. Figure 42 shows this fiber at 60°F. Figure 43 shows the same portion of the fiber, which is now swollen due to treatment in distilled water at 300°F for 36 minutes.

TREATMENT OF DYNEL AT ELEVATED TEMPERATURES———The excellent article by W Rankin and T Newman (*14*) on the dyeing of Dynel within the temperature range 212°F to 220°F prompted this study. The present experiments, made in distilled water, confirm Rankin and Newman's statements that Dynel can be dyed safely for short periods of time at temperatures slightly above 212°F. A knot was tied in the Dynel to aid in the detection of shrinkage or swelling and to assist in locating and photographing the same area. Figure 44 shows the knotted section after the fibers were wet out at 100°F. The bath was then raised to 225°F over a period of 20 minutes, and Figure 45 shows the fiber after two minutes at this temperature. Measurements of the fiber show a decrease in diameter of approximately 22%. The temperature of the bath was then raised gradually to 300°F to permit observation of the behavior and possible degradation of the fiber at these temperatures. The fiber showed very little change in diameter or physical appearance up to 250°F. At 275°F, some swelling had occured so that the fiber now had an overall decrease in diameter of 17% compared with the diameter of the original fiber. When

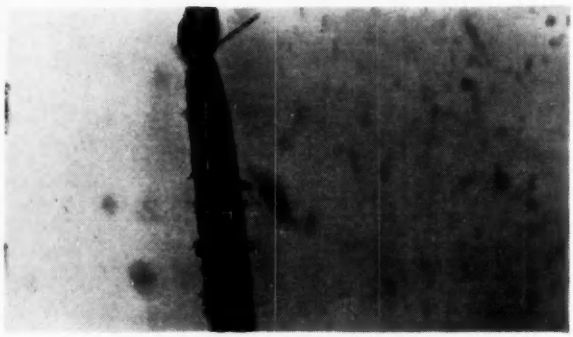


Figure 46
Dynel fiber in distilled water after 54 minutes at 300°F. Fiber shows considerable swelling.

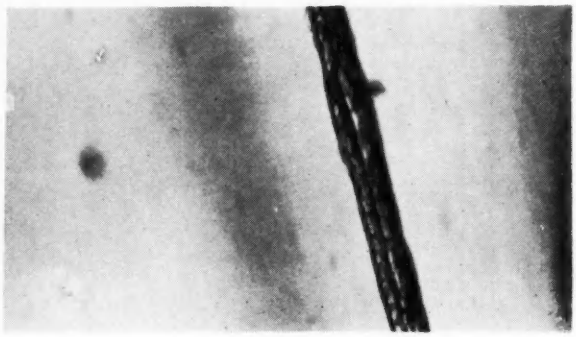


Figure 48
Orlon 42 fiber in alkaline bath at 300°F. Total elapsed time 2 hours and 10 minutes. Fiber had swollen and had ruptured.

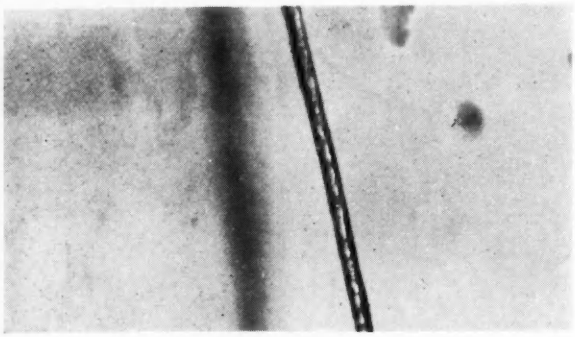


Figure 47
Orlon 42 fiber in a one-sixth of an ounce per gallon solution of caustic soda at 120°F.

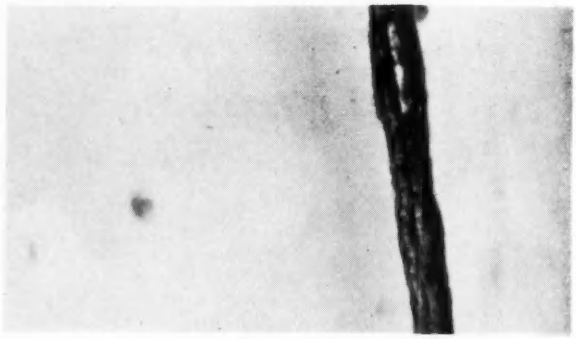


Figure 49
Orlon 42 fiber in alkaline bath at 300°F. Total elapsed time 2 hours and 28 minutes. Further swelling and rupturing had occurred.

the temperature of the bath reached 300°F, the overall decrease in diameter was only 11%. After 14 minutes at 300°F, the Dynel had swollen to 30% above its original diameter. After 54 minutes at 300°F, the fiber showed further swelling and was now approximately 40% larger in diameter than it was at the beginning. (Figure 46). Degradation also was apparent.

It would appear from these results that Dynel can be dyed for short periods of time at temperatures up to about 225°F without causing serious damage. Treatments above 225°F should be avoided except where it is possible to reduce the time of immersion and exposure to 60 to 90 seconds, which may be possible in continuous dyeing.

THE EFFECT OF ALKALI ON ORLON 42———Studies with the high - temperature Microdyeoscope showed that physical and chemical changes take place during high-temperature treatment of acrylic fibers with caustic soda and hydrosulfite. These experiments revealed interesting facts about the structure of the Orlon 42 fiber.

In the early days of Orlon 42 acrylic fiber attempts were made to apply vat dyes from alkaline baths at temperatures above 212°F. Under these drastic conditions, Alkaline hydrolysis occurred, the fiber lost tensile strength and its fine hand, and the batch had a very unpleasant odor when the machine was opened. Modification of the methods of application of vat dyes and a reduction in the pH of the dyebath have overcome this difficulty, and alkaline hydrolysis is no longer a serious problem.

An experiment was made on Orlon 42 fiber using a bath containing one-sixth ounce per gallon of caustic (pH 9) and temperatures up to 300°F to cause the fiber to swell and rupture and to speed the rate of disintegration. Figure 47 shows the fiber as it appeared at a temperature of 120°F. No change was noted as the temperature rose to 212°F. However, at 250°F, thirteen minutes after the start of the experiment, a very slight swelling of the fiber was apparent. At 295°F, after 33 minutes of treatment, no further swelling had occurred. At 295°F, after one hour and 27 minutes of treatment, considerable swelling was noted. At 300°F, after an elapsed time of two hours and 10 minutes, the fiber had swollen to twice its size, it was yellow in color, and considerable damage was evident. (Figure 48). At two hours and 28 minutes, the temperature having been maintained at 300°F, further swelling had occured, the shade of the fiber was yellower, and the fiber had ruptured. (Figure 49). At two hours and 31 minutes, still at a temperature of 300°F, several ruptures had occurred along the fiber with further yellowing. At two hours and 37 minutes (300°F), the fiber was golden yellow in shade and had separated in the center of its dog-bone area. Cross fibrils were observed at regular intervals, which appeared to be more resistant to disintegration than the bulk of the fiber. These cross members probably add to the tensile strength and resilience of the fiber. (Figure 50).

THE EFFECT OF ALKALI AND HYDROSULFITE ON ORLON 42———Another study was made to observe the degradation of Orlon 42 by adding sodium hydrosulfite to the alkaline treating bath. One experiment in which 0.5 oz/gal caustic soda and 0.5 oz/gal hydrosulfite were used

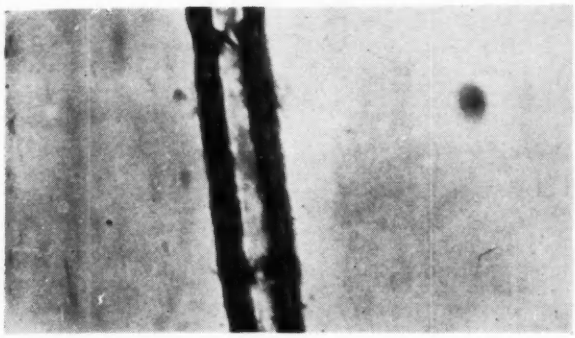


Figure 50
Orlon 42 fiber in alkaline bath at 300°F. Total elapsed time 2 hours and 37 minutes. The fiber was golden yellow, had swollen considerably and separated into two sections.

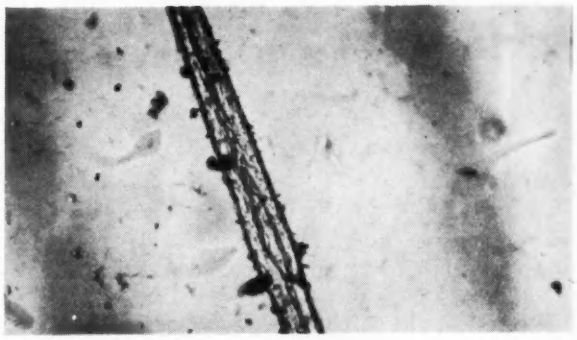


Figure 52
Orlon 42 fiber in caustic and hydrosulfite solution at 300°F after a total elapsed time of one hour and forty-three minutes. Note swelling, rupturing and cross fibrils in center of fiber.

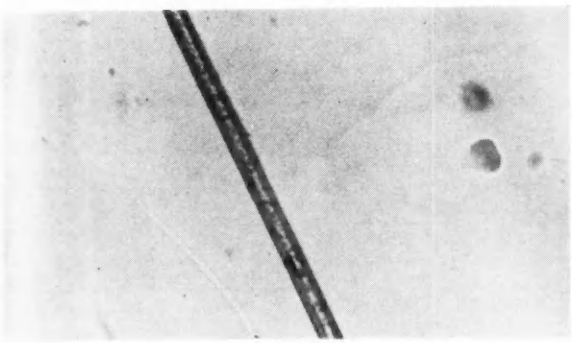


Figure 51
Orlon 42 fiber in a solution containing one-half ounce each of caustic soda and hydrosulfite at 54°F.

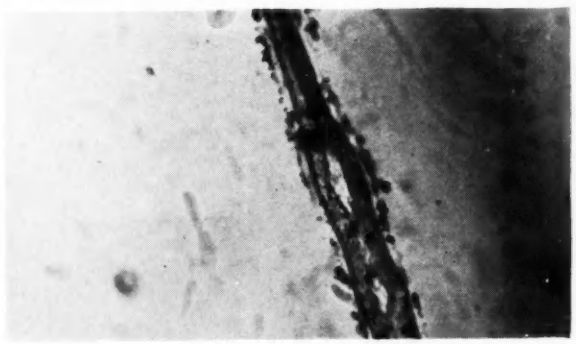


Figure 53
Orlon 42 fiber in caustic and hydrosulfite solution at 300°F after a total elapsed time of one hour and forty-seven minutes. Note rupture and gelatinous film enveloping fiber.

will be described in detail. No vat dye was present. This bath had a pH of 9 at the beginning of the experiment.

Figure 51 shows the fiber as it appeared after three minutes immersion in the caustic-hydrosulfite bath at 54°F. When the bath reached 212°F, after a total elapsed time of 15 minutes, the fiber was swollen very slightly. At 225°F, after 20 minutes total elapsed time, further swelling was noted. At 275°F, after a total elapsed time of one hour and eight minutes, the fiber had increased in size and had started to gelatinize or soften at its surface, which was deduced from the observation that extraneous debris began to adhere to the fiber. A longitudinal rupture and further swelling of the fiber occured as the temperature of the bath was raised to 300°F with a total time of treatment of one hour and 43 minutes. Further accumulation of debris was noted. (Figure 52). After a total elapsed time of one hour and 47 minutes and a temperature of 300°F, the longitudinal rupture had widened and extended the length of the fiber. (Figure 53). After two hours and five minutes total elapsed time and 300°F, a gelatinous film had formed around the fiber and further rupturing and separation of the fiber had occured at the narrow part of the dog-bone structure. (Figure 54). The gelatinous film around the fiber had increased considerably in width, and further rupturing and spreading of the two sections of the fiber occurred during the next 22 minutes of treatment at 300°F with a total elapsed time of two hours and 27 minutes. At two hours and 33 minutes (300°F), the fiber had completely separated into two parts in many places and cross fibrils were visible. (Figure 55). Figure 56, which was photographed at 300°F after two hours and 52 minutes total elapsed time of treatment, shows in somewhat better detail the nature of the cross-linking fibrils that were holding the fiber together. Observation of the splitting of the fiber through the Micro Ibso shows that the Orlon 42 fiber is very tough, and even under such drastic treatments as were used in these experiments, cross fibrils of even more resistant material are present in the fiber which retard or prevent its complete separation and breakdown. It is noted that the gelatinous film was not observed in the absence of hydrosulfite or with lower concentrations of caustic soda.

ADVANTAGES OF HIGH-TEMPERATURE DYEING

Practical and microscopical studies have shown a number of advantages in dyeing at temperatures above 212°F:

1) More rapid rate of penetration and diffusion of dyes into textile fibers
2) More uniform distribution of color from fiber to fiber
3) More rapid leveling in most cases
4) A reduction in time of dyeing
5) Better development of color value
6) A decrease in the quantities of dyes required
7) Makes possible the elimination of carriers in hydrophobic-fiber dyeing
8) Improved fastness to wet finishing for certain fibers and classes of dyes
9) Equal or better fiber properties
10) Saving in steam and power.

Figure 54
Orlon 42 fiber in caustic and hydrosulfite solution at 300°F after a total elapsed time of two hours and twenty-seven minutes. Note swelling, rupturing and the increase in gelatinization.

Figure 56
Orlon 42 fiber in caustic and hydrosulfite solution at 300°F after a total elapsed time of two hours and fifty-two minutes. Note fibrillar nature of fiber in the center at the right hand side.

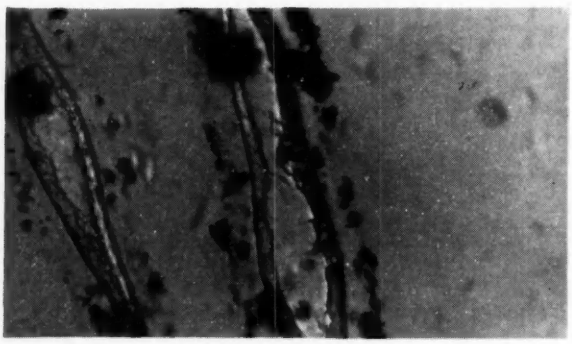


Figure 55
Orlon 42 fiber in caustic and hydrosulfite solution at 300°F after a total elapsed time of two hours and thirty-three minutes. Note the separation of the fiber into two parts and the gelatinization.

PRECAUTIONS NECESSARY WHEN DYEING AT HIGH TEMPERATURES

1) The dyeing or processing time at elevated temperatures must be reduced to a minimum.
2) The material should be immersed in the bath as much as possible.
3) Efficient agitation and circulation of the bath through the material or the material through the bath must be obtained.
4) When processing fabrics, they should be treated in the open width to prevent wrinkles or creases which are difficult, if not impossible, to remove in subsequent lower-temperature baths.
5) The pH of the bath is extremely important and should in most cases be adjusted to the neutral or slightly acid side.
6) Predetermine the stability of the dyes to high-temperature degradation.

ACKNOWLEDGEMENT

The author gratefully acknowledges the assistance of Edwin Skidmore in the building of the high-temperature (pressurized) Microdyeoscope, to Chester Amick for constructive criticism of the manuscript, to Leslie Turl for helpful suggestions, to James Leininger for preparing several of the schematic drawings, to Mrs James Leininger and Florence Gustafson for preparing the fiber frames and to Raymond Krammes and Bernard Barkouskie for preparing the prints used for illustrations.

REFERENCES

(1) Goodall, *J Soc Dyers Col* **54**, 45-63 (1938).
(2) Walter, U S Patent 2,387,200 (1945).
(3) Royer, Zimmerman, Walter, and Robinson, *Textile Research J* **18**, 598 (1948).
(4) Millson and Turl, *ibid* **21**, 685-702 (1951).
(5) Millson, *Am Dyestuff Reptr* **44**, 417 (1955).
(6) Bagian, *Textile Age* **19**, 55 (1955).
(7) Iannarone Jr, *Can Textile J* **74**, 47 (1957).
(8) Datyner, *Dyer* **116**, 767-772 (1956).
(9) Gaston County Advertisement, *Am Dyestuff Reptr* **41**, LI (Sept 15, 1952).
(10) Millson, *Melliand Textile Monthly* **3**, 1349; 1475 (1931).
(11) Millson, *Am Dyestuff Reptr* **47**, 221 (1958).
(12) Mecco, American Cyanamid Company, U S Patents 2,548,543-6; 2,576,846-7; 2,683,645; 2,803,516.
(13) Fordemwalt, U S Patents 2,690,952 and 2,683,646.
(14) Rankin and Newman, *Am Dyestuff Reptr* **45**, 213-214 (1956).
(15) Watkins, Royer, and Millson, *ibid* **33**, 52 (1954).
(16) Millson and Turl, *ibid* **39**, 647 (1950).

BIBLIOGRAPHY

Baques, "The Dyeing of Wool and Mixtures Containing Wool at Temperatures Above 100°C", *Ing Textile* (Barcelona) **22**, 554 (1955).
Blackburn and Fox, "The Behavior of Leuco Vat Dyes Above 100°C", *J Soc Dyers Col* **71**, 80 (1955).
Butterworth, "The Dyeing of Viscose Rayon at High Temperatures", *ibid* **69**, 362 (1953).
Cole, "Revolution in Batch Dyeing", *Modern Textiles*, 76 (1952).
Cole, "Barotor—Pressurized Fabric-Dyeing Machine", *Am Dyestuff Reptr* **42**, P66 (1953).
Cooke, "Dyeing Viscose Rayon Above 100°C", *Textile Mfr* **82**, 140 (1956).
Coutie, Lemin, and Sagar, "Some Observations on the Dyeing of Wool at High Temperatures", *J Soc Dyers Col* **71**, 433 (1955).
Drijvers, "Dyeing of Fibers at High Temperatures", *Am Dyestuff Reptr* **41**, 533 (1952); *Can Textile J* **70**, 57 (1953).
Fern, "The Dyeing of Terylene Polyester Fibers with Disperse Dyes Above 100°C", *J Soc Dyers Col* **71**, 502 (1955).
Ferré, "Dyeing of Man-Made Fibers at High Temperature", *Ing Textile* (Barcelona) **22**, 535 (1955).
Fowler, "The Dyeing of Textile Fibers Above 100°C", *J Soc Dyers Col* **71**, 443 (1955).
Fox, "Work of Dyes at High Temperatures", *Can Textile J* **71**, 51-5 (1954).
Iannarone Jr, Clapham, and Thomas, "Some Phases of High-Temperature Dyeing", *Am Dyestuff Reptr* **42**, P66 (1953).
Justice, "Dyeing Above 100°C", *Textilber* **34**, 1148 (1953).
Lemin, "High-Temperature Dyeing of Wool", *J Soc Dyers Col* **72**, 31 (1956).
Philadelphia Section, AATCC, "The Application of Chemical Controls to Acid Dyeing", *Am Dyestuff Reptr* **37**, P149 (1948).
Philadelphia Section, AATCC, "Some Phases of High-Temperature Dyeing", *ibid* **38**, P9-32 (1949).
Reith and Andres, "Dyeing Fabrics Under Pressure", *ibid* **42**, P35 (1953).
Rogers, *Textile J Australia* **29**, 1400 (1955).
Roy, "Some Practical Procedures for Dyeing Cotton for the High-Temperature Dyeing of Synthetic Fibers", *Am Dyestuff Reptr* **41**, P844 (1952).
Schofield, "Pressure Dyeing Terylene", *Dyer* **117**, 69 (1957).
Schuler, "The Mechanism of Carrier Action in Dyeing Dacron Polyester Fiber", *Textile Research J* **27**, 352 (1957).
Sharma, *Colourage* **3**, 17-20, 45-48 (1956).
Stanziola and Fordemwalt, "The High-Temperature Dyeometer—An Instrument for Recording the Application of Dyes at Elevated Temperatures", *Am Dyestuff Reptr* **45**, 365 (1956).
Steiner, "Wool Processing Here and Abroad", *ibid* **44**, 212 (1955).
Vogel and Peter, "Developments in the Field of High-temperature Dyeing", *Textil-Rundschau* **10**, 175 (1955).
Zimmerman, "The Application of Dyes to Textile Fibers at High Temperatures", *ibid* **42**, P19 (1953).
Zimmerman, "Some New Approaches to the Study of High-Temperature Dyeing", (to be published).

"Assuring Advancement Through Cooperating Committees"———

THIRTY-SEVENTH NATIONAL CONVENTION

THE Thirty-Seventh Annual AATCC Convention will be held October 30, 31 and November 1, 1958 under the auspices of the Western Region at the Conrad Hilton Hotel, Chicago, Ill. The Western Region, which includes the Mid-West, Pacific Northwest and Pacific Southwest Sections, extends a warm invitation to all members and their guests to attend this Convention.

The Conrad Hilton Hotel, the largest hotel in the world, contains 3,000 guest rooms, and those planning to attend the Convention are assured of space under one roof. All Convention activities, such as technical meetings, banquets and luncheons, as well as our exhibit, will also be housed in the Conrad Hilton Hotel.

The theme of this year's Convention is:

A A T C C
Assuring Advancement Thru Cooperating Committees

To quote Elliott Morrill, The Best Foods, Inc, AATCC vice president and chairman of the '58 Convention:

> "The heart of the AATCC program lies in the 66 committees, working under the Technical Committee on Research. Manned by over 400 volunteer working members and our associates in AATCC, supported by the National Headquarters' staff and laboratory facilities, these committees implement the objects of our Association and assure continual advancement in acquiring and disseminating knowledge of our scientific and technical endeavors.

The various technical committees of AATCC are planning to present exhibits of their various activities. These will be quite elaborate, and will take the place of the regular commercial exhibits which have previously been a part of our Convention. These exhibits are planned to familiarize all of our members with the varied activities of the National Technical Committees of the AATCC and will be of extreme interest to all.

Subjects for the five technical programs have been carefully selected and will concern activities of current interest in our textile industry. These subjects will be presented by a select group of speakers chosen for their prominence in the textile field.

The City of Chicago is unsurpassed, either in quality or variety, for its outside activities and entertainment—in the field of sports, such as football and horse racing, and also its night life.

An extremely entertaining program is being planned for our lady guests, which will include attendance at a nationally known radio broadcast, and a luncheon and style show at a nationally prominent restaurant.

PLAN TO SPEND A PORTION OF YOUR VACATION IN CHICAGO THIS YEAR AND ATTEND THE NATIONAL MEETING. We can assure you that you will have a most profitable and enjoyable time.

Chicago skyline with the Conrad Hilton Hotel in foreground

1958 CONVENTION

Executive Committee

Chairman
ELLIOTT MORRILL
The Best Foods, Inc

Assistant Chairman
EDWIN I STEARNS
American Cyanamid Co

Secretary
RICHARD R FREY
AATCC Headquarters

Entertainment
J GORDON STOTT
Ciba Co, Inc

Dining
WARREN B BROADBENT
Geigy Dyestuffs

Finance
VICTOR C BRAUN
Acme Galvanizing, Inc

Hotel
ERWIN J SINDT
National Aniline Div

Ladies
ARCHIE G ALEXANDER
Arkansas Co, Inc

Printing
JOHN L EICH
General Dyestuff Co

Publicity
JACK G KELLEY
E I duPont de Nemours & Co, Inc

Reception
DAVID A ANDERSON
Phoenix Trimming Co

Registration
FRANK S STOVER
Koppers Co, Inc

Technical Program
LEONARD J ARMSTRONG
Varney Chemical Corp

Transportation
H THOMPSON LATHAM
E I duPont de Nemours & Co, Inc

ACTIVITIES OF THE LOCAL SECTIONS

Southeastern

THE 1958 spring meeting of the Southeastern Section was held on April 19 in Opelika and Auburn, Alabama. Approximately 125 members and guests attended the technical session at Auburn and the Banquet in Opelika. Arrangements for the meeting were made by Sectional Committeeman Val Winkelman Jr, Russell Manufacturing Co, Alexander City, Ala.

Speaker at the technical session was Hector C Borghetty, Rohm & Haas Co, Philadelphia, Pa, who spoke on "Wash-Wear Resins for White Cotton Fabrics".

Following the technical session the members and guests drove to nearby Opelika for a banquet featuring a steak dinner and musical selections by the Girls Sextet of Alabama Polytechnic Institute.

Ladies at the meeting were entertained in the Student Union Building at Auburn, Mrs Louise Winkleman serving as hostess.

William B Griffin, chairman of the Section, expressed gratitude to all members for their splendid cooperation in the Section Membership Drive and announced that the goal of 301 senior members had been reached. Turning to Corporate Membership, he urged all members to provide information to assist the National office in canvassing prospective corporate members. Forms and literature about this were passed out to the members by George Dozier, chairman, Corporate Membership Committee.

Cecil B Ray was appointed to serve as chairman of the Section's Standing Committee on Research.

Warren Tiller, secretary of the Southeastern Section, delivers his report as Val Winkleman Jr (seated), who had charge of the April 19th meeting, listens.

Hector C Borghetty, Rohm & Haas Co, guest speaker delivering his talk, "Wash-Wear Resins for White Cotton Fabrics".

Girls' Sextette from Alabama Polytechnic Institute provided musical entertainment.

Rhode Island

THE Rhode Island Section held its annual Students Night on April 25th at the New Beford Institute of Technology, New Bedford, Mass, with 120 in attendance.

Prof J B Quig of Lowell Technological Institute summarized his work on man-made fibers while he was with the Du Pont Company.

The Section presented awards of the book, "Technology of Dyeing" by Thomas Vickerstaff to the following students: Kenneth J Provost, New Bedford Institute of Technology; Edgar I Broadhead Jr, Rhode Island School of Design; Edwin C Boyle, Bradford Durfee College of Technology. Mr Boyle was not present, but his award was accepted by Leslie Coombs of BDCT.

Arrangements for the meeting were in the hands of James A Davies, Arnold, Hoffman & Co, Inc.

* * *

Kenneth J Broden, The Sherwin-Williams Co, has completed the appointment of his committee and many of the details, concerning the Rhode Island Section 25th Annual Outing and Golf Tournament, to be held at the Wannamoisett Country Club, Rumford, RI on June 13th.

Because this is the Section's Silver Anniversary Outing, several new items of interest have been added to the event this year. In the Golf Tournament there will be two chances for golfers to claim "nearest-the-pin" and two for the "longest drive". Instead of the usual Putting Contest, the Committee has arranged for unique Obstacle Putting Contest, thereby giving everyone an opportunity to win.

The Callaway Handicap System will prevail for the Tournament. The low gross trophy was won last year by George E Montgomery of the Arkansas Co, Inc; in 1956, by John R Janket of Putnam-Herzl Finishing Co, Inc; and in 1955 & 1954, by Thorwald Larson, Carbic Color & Chemical Co, Inc. Three legs on this trophy decides the permanent owner.

Plagiarizing an outing custom from the Metropolitan Section, the RI Committee is conducting a Sport Shirt Contest. A prize will be given for the most unusual shirt worn and the committee will be unconcerned as to whether the shirt is purchased, home-made, dip-dyed, hand-printed or brush-painted. Anything goes! It is suggested that dark glasses be worn that day.

Luncheon will be served between 11:30 am and 2:00 pm; dinner at 7:00 pm. At the close of dinner, golf prizes and trophy will be distributed along with a large number of door prizes.

Serving with Mr Broden on the Outing Committee, are: *Assistant Chairman*—Charles F Stokes, Carbic Color & Chemical Co, Inc; *Tickets-Treasurer*—Walter S. Murray, Crown Chemical Co; *Printing and Publicity*—Harrison M Gorton Jr, Koppers Co, Inc; *Prizes*—James C Shore, Metro-Atlantic, Inc; *Photography*—Kenneth C Everett, Kenyon Piece Dyeworks, Inc, and John E Trezise, Karasell Chemical Corp; *Lunch & Dinner*—Raymond K Andrew, U S Oil Co; *Golf*—Walker C McBeath, American Cyanamid Co; and *Advisory*—Arthur Hustwit, Soluol Chemical Co.

Those wishing tickets to attend this Outing and Golf Tournament should make early reservations with Walter E Murray, Crown Chemical Co, 240 India Street, Providence, RI.

Metropolitan

PETER Scott, vice president, The Tanatex Chemical Corp, spoke on the subject, "Evaluation of Carriers for Dacron Dyeing", before an audience of 180 at the April 18th meeting of the Metropolitan Section.

Chairman Donald E Marnon presided at the meeting, held at Kohler's Swiss Chalet, Rochelle Park, NJ. In attendance was a four-man delegation from the Delaware Valley Section.

Mr Marnon called on Michael F Costello, chairman of the Section's Annual Outing & Golf Tournament, which is set for June 6th at the North Jersey Country Club, Wayne, NJ. In his report, Mr Costello urged members to send in their reservations promptly to avoid disappointment, pointing out that the demand for tickets for last year's outing exceeded the supply of tickets for the event.

The Section's 1958 Ladies Night Program is still under advisement. It will probably be held in the fall.

VOLUME 3

COLOUR INDEX

IS HERE.

ORDER NOW!

AATCC Calendar

COUNCIL

May 23 (Sheraton Hotel, Philadelphia, Pa); Sept 19 (Charlotte, NC); October 30 (Conrad Hilton Hotel, Chicago, Ill); May 1959 (Montreal, Canada)

NATIONAL CONVENTIONS

Oct 30-Nov 1, 1958 (Hotel Conrad Hilton, Chicago); Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); September 28-30, 1961 (Buffalo, NY)

DELAWARE VALLEY SECTION

May 23 (Outing, Torresdale-Frankford Country Club), Sept 12 (Wilmington Meeting), Oct 17, Dec 5

HUDSON-MOHAWK SECTION

June 20 (Annual Outing, Antler's Country Club, Ft Johnson, NY)

METROPOLITAN SECTION

June 6 (Outing, North Jersey Country Club, Wayne Township, NJ)

MID-WEST SECTION

June 13-14 (Outing—Browns Lake Resort, Burlington, Wis)

NIAGARA FRONTIER SECTION

June 27 (Annual outing); Sept 26 (Niagara Falls, Ont); Oct 24 (joint meeting with CATCC at St Catherines, Ont)

NORTHERN NEW ENGLAND SECTION

Sept 12 (Outing—Wachusett Country Club, West Boylston, Mass); Oct 17 (QM Research & Development Ctr, Natick, Mass); Dec 5 (Hotel Vendome, Boston, Mass); Jan 16 (Colonial Club, Lynnfield, Mass)

PIEDMONT SECTION

June 6-8 (Outing—Grove Park Inn, Asheville, NC); Sept 19-20 (Hotel Charlotte, Charlotte, NC)

RHODE ISLAND SECTION

June 13 (25th Annual Outing—Wannamoisett Country Club); Sept 26 (Management Night—Warwick Country Club); Oct 23 (Providence Engineering Society); Dec 4 (Annual Meeting—Johnson's Hummocks Grille, Providence)

SOUTH CENTRAL SECTION

May 30-31 (Summer outing—Hotel Greystone, Gatlinburg, Tenn); Sept 13 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION

June 6-7 (Summer outing—Radium Springs Lodge, Radium Springs, Ga); Sept 13 (Ida Cason Callaway Gardens, Chipley, Ga); Dec 6 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

June 13 (Outing—Wallingford Country Club, Wallingford, Conn); Sept 26 (Hartford, Conn); Oct 24 (Annual Meeting—Rapp's Restaurant, Shelton, Conn; Dec 5 (Rapp's Restaurant, Shelton, Conn)

Membership Applications

SENIOR

Richard E Davies—Supervisor of polymer research, chemist, Air Reduction Co, Inc, Murray Hill, NJ. Sponsors: D B Thornton, B S Sprague. (Met).

William H Greene—Supt of pilot dyeings, Abbeville Mills Corp, Abbeville, SC. Sponsors: C B Palmer, J S Beattie. (P).

Rudolph Jesel—Sales & lab service, Geigy Dyestuffs, Div of Geigy Chemical Corp, Toronto, Ontario, Canada. Sponsors: K A Lister, E R Eakins.

David R Lassiter—Sales, National Starch Products Inc, New York, NY. Sponsors: R E Rettew, W L Beaumont. (Met).

Harold Roberts—Head dyer, American Finishing Co, Memphis, Tenn. Sponsors: J P Duffy, H G Smith. (SC).

Jack A Roddy—Supt, beam dyeing, Eagle & Phenix Dye Co, Columbus, Ga. Sponsors: W H Jackson, L Tigler. (S).

Alex F Salerno—Colorists, Organic Chemicals Div, American Cyanamid Co, Bound Brook, NJ. Sponsors: A F Klein, L J Manara Jr. (Met).

John Sauls—Overseer, bleaching, Reeves Bros, Eagle & Phenix Div, Columbus, Ga. Sponsors: H J Gambert, L Tigler. (S).

Nicholas Vlachos — Foreman, Finishing Dept, Finishers & Dyers of Synthetic Products, Kenyon, R I. Sponsors: J W Timperley, J J Hepburn. (RI).

Frank R Wean—Lab tech, colorfastness evaluation, Celenese Corp of America, Charlotte, NC. Sponsors: C S Clutz, W A O'Brien. (P).

ASSOCIATE

William P Anderson — Salesman, Bradford Southern Chemical Co, Greensboro, NC. (P).

Ruth W Ayres—Head, Clothing & Textile Dept, College of Home Economics, The Pennsylvania State Univ, University Park, Pa.

Virginia Davis—Extension clothing specialist, Univ of Massachusetts, Amherst, Mass. (NNE).

Sarah L Hawes—Asst prof, textiles & clothing, School of Home Economics, Univ of Massachusetts, Amherst, Mass. (NNE).

Alfred Hopton—Research, testing & consulting, Niagara Industrial Lab, Niagara Falls, NY. (NF).

Ruth E Knoch—Extension clothing specialist, Agricultural Extension Service, Univ of West Virginia, Morgantown, W Va. (P).

Frank D Lemma—Sales mgr, Northwest Copper Works, Inc, Portland, Ore. (PN).

Eunice M Martin—Head, Dept of Home Economics, Textiles & Clothing, Seattle Univ, Seattle, Wash. (PN).

Sister Mary Claudine—Head, Clothing & Textile Dept, Cardinal Stritch College, Milwaukee, Wis. (MW).

Ramanal Panchal—Dyeing, bleaching & finishing master, Amalner (East Khandesh), India.

Stella B Schulz—Asst prof, Dept of Home Economics, Northwestern Univ, Evanston, Ill. (MW).

Thelma L Thompson—Clothing specialist, Agricultural Extension Service, Univ of California, Berkeley, Calif. (PS).

William S Ward—Salesman, Bradford Southern Chemical Co, Greensboro, NC. (P).

JUNIOR

William P Gilbert—Chemist, Union Bleachery, Greenville, SC. Sponsors: J D Kilgare, C J Graham. (P).

STUDENT

Eleanor Chenault — Student, Alabama Polytechnic Institute, Auburn, Ala. Sponsor: J H Cox. (API).

I H Thaker—Graduate student, Lowell Technological Institute, Lowell, Mass. Sponsor: G Griffin. (LTI).

TRANSFER TO SENIOR

James G Wylie—Colorist, E I duPont de Nemours & Co, Inc, Atlanta, Ga. Sponsors: A Fisher Jr, L A Burroughs. (S).

Sherman Lein—Textile chemist & vice president, Arista Novelty Print Co, Inc, Brooklyn, NY. Sponsors: G M Greenberg, R H Freeman. (Met).

Elected to Membership

April 24, 1958

SENIOR

John Ernyei
Sam Goldman
T P Middlebrooks
L J Morris Todd

ASSOCIATE

E Van Den Heuvel
James N Leonard

STUDENTS

Beryl Bodily
Joan L Mraz
Robert L Samson

TRANSFER TO SENIOR

Charles D Flamand
Charles W Funderbunk
Harry Weisberg

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

58-8

Education: Univ of Cincinnati, Ph D chemistry.

Experience: 21 years, variously as organic chemist (isolation and identification), biochemist (amino acids and vitamins), textile chemist (thermosetting and thermoplastic resins, catalysts, and softeners; syntheses and applications, lab and mill), and consultant. Speak, read, and write 9 languages. Honor societies, publications, and patents. Resume on request.

Age: 42; single; 1 dependent; references.

Position desired: Research director, assistant research director, senior research chemist, technical service.

Location desired: New England; Continental USA and foreign acceptable.

58-9

Education: Diplomas from Biella Professional School, Ecole Superieure de Chimique Textile Roubaix, and St Gal (Swiss Chemistry School of Analysis).

Experience: Wool finisher, sorter; dyer, wool tops and piece goods, cottons, synthetics, piece goods packages and skeins; consultant. Languages: Italian, English, French, some Spanish.

Age: 51; no dependents; references.

Position desired: Dyemaster, woolen mill.

Location desired: Open, USA.

58-10

Education: Chemistry, physics, engineering, Wigan College of Technology; dyeing, Manchester College of Technology; plastics chemistry, McGill Univ.

Experience: Foreman-dyer, English dyeing firm; assistant manager, dye manufacturer; superintendent, general superintendent, consultant, Canadian cotton mills; general manager, large USA textile manufacturer.

Age: 50; married; references.

Position desired: Management, superintending or consulting.

Location desired: Open, USA.

ORGANIZATION OF THE AATCC

FOUNDER

LOUIS A OLNEY
(deceased)

COUNCIL OF THE ASSOCIATION

PRESIDENT ..... GEO O LINBERG, Synthron, Inc, Ashton, RI
Mailing address: 19 Madison Ave, Newtonville 60, Mass

VICE PRESIDENTS .....(*Central Atlantic Region*): WELDON G HELMUS, Fair Lawn Finishing Co, Fair Lawn, NJ; (*New England Region*): ERNEST R KASWELL, Fabric Research Laboratories, Inc, 1000 Providence Highway, Dedham, Mass; (*Southern Region*): H GILLESPIE SMITH, American Cyanamid Co, 1370 Spring St, NW, Atlanta 9, Ga; (*Western Region*): ELLIOTT MORRILL, The Best Foods, Inc, 1437 West Morris St, Indianapolis 6, Ind

TREASURER.....ROLAND E DERBY, Textile Aniline & Chemical Co, Box 899, Lawrence, Mass

EXECUTIVE SECRETARY.....GEORGE P PAINE, AATCC National Headquarters, PO Box 28, Lowell, Mass

CHAIRMAN, EXECUTIVE COMMITTEE ON RESEARCH..... CHARLES W DORN, Suite 1300, 369 Lexington Ave, New York 17, NY

PAST PRESIDENTS (Living).....ELVIN H KILLHEFFER, P J WOOD, WILLIAM H CADY, ALBAN EAVENSON, CARL Z DRAVES, THOMAS R SMITH, WILLIAM D APPEL, HENRY F HERRMANN, C NORRIS RABOLD, J ROBERT BONNAR, RAYMOND W JACOBY

NATIONAL COUNCILORS REPRESENTING SECTIONS..... (*Northern New England*): PHILIP S DURFEE, JOHN J HEALY, FRANK J RIZZO; (*Rhode Island*): REMUS F CAROSELLI, FRANCIS H CASEY, RAYMOND B TAYLORSON, J WILLIAM TIMPERLEY; (*Western New England*): JOHN E HIRN, J EDWARD LYNN; (*Delaware Valley*): CARLETON T ANDERSON, WILLIAM H BERTOLET 3RD, THOMAS H HART, DONALD W ROBINSON, CLARENCE A SEIBERT; (*Hudson-Mohawk*): JOHN J HANLON; (*Metropolitan*): PERCY J FYNN, ARTHUR J KELLNER, PAUL J LUCK, DONALD E MARNON, RICHARD P MONSAERT JR, BRENDAN F QUIGLEY, MAX W WINKLER; (*Niagara Frontier*): BERNARD K EASTON; (*Piedmont*): A HENRY GAEDE, CLARENCE HOOPER, JOHN V KILLHEFFER, EDWARD A MURRAY, PAUL B STAM, NEAL A TRUSLOW; (*South Central*): JACK ANDERSON; (*Southeastern*): WILLIAM E FAYSSOUX, T HOWARD McCAMY; (*Washington*): LEONARD SMITH; (*Mid-West*): ARTHUR I HULTBERG, JOSEPH H JONES, J GORDON STOTT; (*Pacific Northwest*): JOHN L AYRES; (*Pacific Southwest*): MELVILLE H BEHRENDT

TREASURER EMERITUS

WILLIAM R MOORHOUSE
PO Box 352, South Yarmouth, Mass

CHAIRMEN, COMMITTEES OF THE COUNCIL

STANDING COMMITTEES—

Executive Committee on Research	CHARLES W DORN
Technical Committee on Research	CHARLES A SYLVESTER
Publicity	GEORGE P PAINE (pro tem)
Appropriations	ROLAND E DERBY
Membership and Local Sections	WELDON G HELMUS
Publications	WALTER M SCOTT
Corporate Membership	ALBERT E JOHNSON
Constitution and Bylaws	WILLIAM R HOLST
Conventions	ERNEST R KASWELL
Technical Programs	LEONARD W ARMSTRONG
Technical Supplies	GEORGE P PAINE
Archives	SIDNEY M EDELSTEIN
Intersociety Relations	CARL Z DRAVES
Textile Education	HENRY A RUTHERFORD
Subject and Speakers' Bureau	MATTHEW J BABEY

SPECIAL COMMITTEES—

President's Advisory	J ROBERT BONNAR
Colour Index Marketing	ROLAND E DERBY
Colour Index Editing	WILLIAM H CADY
Bibliography	WILLIAM H CADY
Intersectional Contest	THOMAS J GILLICK JR
OM—Air Force Dye Survey	WILLIAM A HOLST
Employee Retirement and Pension	WALTER J HAMBURGER

NATIONAL HEADQUARTERS

SENIOR STAFF—

Executive Secretary	GEORGE P PAINE
Director of Research	HAROLD W STIEGLER
Assistant Secretary	RICHARD R FREY
Technical Manager	GEORGE I MANDIKOS
Administrative Manager	J ROBERT THOMPSON
Research Associate	GLEN M KIDDER
Research Associate	HARLAN E GLIDDEN

LOCAL SECTION OFFICERS

New England Region

NORTHERN NEW ENGLAND.....*Chairman*: EDWARD B BELL, Textile Aniline & Chemical Co, 49 Blanchard St, Lawrence, Mass; *Secretary*: AZEL W MACK, Dexter Chemical Corp, 100 Memorial Drive, Cambridge 42, Mass; *Vice Chairman*: ROBERT D ROBINSON; *Treasurer*: WILLIAM W PENNOCK

RHODE ISLAND.....*Chairman*: THORWALD LARSON, Carbic Color & Chemical Co, Inc, 87 Weybosset St, Providence 3, RI; *Secretary*: HARRISON M GORTON JR, American Aniline Products, 1430 Elmwood Ave, Providence, RI; *Vice Chairman*: ROBERT H PHILLIPS; *Treasurer*: HAROLD B STURTEVANT

WESTERN NEW ENGLAND.....*Chairman*: JOHN J CERVINI, Cheney Bros Inc, Manchester, Conn; *Secretary*: TIMOTHY J HORAN, Princeton Knitting Mills, Echo Lake Rd, Watertown, Conn; *Vice Chairman*: ANDREW W GOODWIN; *Treasurer*: PETER P DuBIEL

Central Atlantic Region

DELAWARE VALLEY.....*Chairman*: WILLIAM S SOLLENBERGER, American Viscose Corp, Marcus Hook, Pa; *Secretary*: ERNST W EMPTING, Verona Dyestuffs, 357 Lancaster Ave, Haverford, Pa; *Vice Chairman*: L KEVIN McCHESNEY; *Treasurer*: CLARENCE A SEIBERT

HUDSON-MOHAWK.....*Chairman*: EDWARD A CHEVRETTE, Apex Chemical Co Inc, 28 Oxford Rd, Albany, NY; *Secretary*: FLOYD J SZUREK, Mohasco Industries, Inc, Amsterdam, NY; *Vice Chairman*: MAURICE FISHMAN; *Treasurer*: WALTER DRAUTZ

METROPOLITAN.....*Chairman*: DONALD E MARNON, Berkshire Color & Chemical Co, 250 Delawanna Ave, Delawanna, NJ; *Secretary*: RICHARD P MONSAERT JR, Puritan Piece Dye Works, 550 E 38th St, Paterson, NJ; *Vice Chairman*: JOHN A KOMNINOS; *Treasurer*: RICHARD E MILLER

NIAGARA FRONTIER.....*Chairman*: WILLIAM H LEYKING, National Aniline Div, Allied Chemical & Dye Corp, 1015 S Park Ave, Buffalo, NY; *Secretary*: NORBERT WEINBERG, Becco Chemical Div, Food Machinery & Chemical Corp, Sta B, Buffalo 7, NY; *Vice Chairman*: KENNETH A LISTER; *Treasurer*: ANTON M VIDITZ-WARD

Southern Region

PIEDMONT.....*Chairman*: WARREN E RIXON, Union Carbide Chemicals Co, 1213 Liberty Life Bldg, Charlotte, NC; *Secretary*: LINTON C REYNOLDS, Riegel Textile Corp, Ware Shoals, SC; *Vice Chairman*: JOSEPH C KING; *Treasurer*: VINCENT B WRIGHT JR

SOUTH CENTRAL.....*Chairman*: ERNEST V HELMS, Geigy Dyestuffs, 1208 E 23rd St, Chattanooga 4, Tenn; *Secretary*: EDWIN F JURCZAK, Burkart-Schier Chemical Co, 13th and Chestnut Sts, Chattanooga, Tenn; *Vice Chairman*: FRANKLIN E CATER; *Treasurer*: ROBERT N INGRAM

SOUTHEASTERN.....*Chairman*: WILLIAM B GRIFFIN, Dexter Chemical Corp, 218 Beverly Rd NE, Atlanta, Ga; *Secretary*: WARREN E TILLER, Tennessee Corp, 617-29 Grant Bldg, Atlanta 1, Ga; *Vice Chairman*: ROBERT B HALLOWELL; *Treasurer*: WILLIAM B AMOS

WASHINGTON.....*Chairman*: GEORGE P FULTON, National Institute of Drycleaning, 909 Burlington Ave, Silver Spring, Md; *Secretary*: NELSON F GETCHELL, National Cotton Council of America, 1832 M St NW, Washington 6, DC; *Vice Chairman*: ARNOLD M SOOKNE; *Treasurer*: LOUIS R MIZELL

Western Region

MID-WEST.....*Chairman*: JACK G KELLEY, E I duPont de Nemours & Co, Inc, 7 S Dearborn St, Chicago 3, Ill; *Secretary*: WALTER H SITES, Ciba Co, Inc, Box 216, Skokie, Ill; *Vice Chairman*: JAMES L McGOWAN; *Treasurer*: FRANK H GURRY

PACIFIC NORTHWEST.....*Chairman*: BERNARD R KOENIG, Portland Woolen Mills, 639 N Baltimore St, Portland, Ore; *Secretary*: PAUL J PERNICE, General Aniline & Film Corp, 1007 Terminal Sales Bldg, Portland 5, Ore; *Vice chairman*: JACK D GILBERG; *Treasurer*: DALE W KIMSEY

PACIFIC SOUTHWEST....*Chairman*: HAROLD W ELLSWORTH, West Coast Carpet Dyers, 14747 Keswick St, Van Nuys, Calif; *Secretary*: FERD H AHL JR, E I duPont de Nemours & Co, Inc, 2930 E 44th St, Los Angeles 58, Calif; *Vice Chairman*: PAUL F NOONAN; *Treasurer*: WALTER E KRAMER

STUDENT CHAPTERS

Alabama Polytechnic Institute, Bradford Durfee College of Technology, Clemson College, Georgia Institute of Technology, Lowell Technological Institute, New Bedford Institute of Technology, North Carolina State College, Philadelphia Textile Institute, Rhode Island School of Design

NOTICE TO AUTHORS OF PAPERS

MANUSCRIPTS for the *Proceedings* and for other publications of the American Association of Textile Chemists and Colorists shall conform to the requirements and standards given in this *Notice*. Before publication, manuscripts for the *Proceedings* shall be approved by the Editor, not only for editorial correctness according to the standards of this *Notice*, but also for content of technical matter. In his work, the Editor may enlist the aid of anonymous reviewers who are selected for expert knowledge in particular fields.

It is presumed that authors in studying the comments of reviewers and of the Editor will remember that all recommendations are made in a kindly, helpful, sympathetic manner to improve the paper in both literary and technical excellence. Although authors should cheerfully consider suggestions, they are expected to defend their position if justified, especially when strictly technical matters are involved with which the authors have an intimate knowledge.

AATCC strives to maintain a high scientific and professional standard for papers. Authors must make every effort to avoid the use of trade names, commercial products or process names wherever such use may be construed as advertising. Wherever possible, scientific nomenclature must be employed. It is recognized that in some instances trade names are necessary to avoid lengthy description. Certain trade names have been so widely used as to become generic and these normally are permissible. Further, some technical papers may involve the presentation of a new product or process wherein trade name reference is obligatory.

Giving due consideration to such valid exceptions, it is incumbent upon the author to maintain the proper scientific attitude, avoiding any expressions or devices aimed at promoting a particular product or process.

Questionable papers are to be referred to the chairman of the Publications Committee, who will submit them to an editorial board which would be appointed as needed. The Board would report to the Publications Committee, which would have the final voice in accepting or rejecting a paper.

MANUSCRIPTS — Manuscripts shall be typewritten double-spaced with approximately one-inch margins on 8.5x11-inch white paper. In addition to the *original*, at least one carbon copy is required. Pages are to be numbered consecutively with Arabic numerals, and each page after the first shall carry the authorship at the very top. Tables and figures shall also be numbered consecutively, the tables with headings containing Roman numerals as TABLE I, TABLE II, etc, and the figures with Arabic numerals as Figure 1, Figure 2, etc, appearing *below* the figures. The names of the authors and their laboratories or business connections should appear below the title of the paper.

LITERARY STYLE AND FORM OF PRESENTATION—In the writing of papers, authors are requested to observe a trenchant, simple style of writing directed to textile chemists and colorists with at least an elementary knowledge of chemistry, physics, mathematics, engineering, textile processes and textile machinery.

In the organization of the material, there should be one or more introductory paragraphs setting forth the occasion, significance and main objectives of the paper and of the method of attack. This should be followed by the body of the presentation, either with discussions interspersed throughout this portion or with a collected section marked "DISCUSSION" after the main body of the paper. Finally, there may be a brief section at the end entitled "SUMMARY" or "CONCLUSIONS."

Center and side headings make for easier reading. Center headings should be employed sparingly and generally will include only very important section headings, such as "INTRODUCTION," "EXPERIMENTAL," "DISCUSSION," "CONCLUSIONS," "SUMMARY," and "REFERENCES." Side headings (see sixth paragraph of this *Notice* for an example) shall be indented and run into the text to which they apply, and shall be separated from the paragraph by a dash. The publisher will print center headings in bold-face capitals and side headings in capitals.

LITERATURE REFERENCES AND FOOTNOTES—References to the literature and all footnotes (except those in tables) shall be numbered consecutively with underlined Arabic numerals in parentheses at the proper place in the text. Where a reference or footnote is to be used again, the original number is simply repeated; this obviates the necessity of repeating the footnote or reference at the bottom of the page. Reference to the literature shall conform to the universal usages followed by *Chemical Abstracts*, which include underlining of journal names to indicate italicization in printing. The abbreviated codes for many journal names appear on page 143 of the 1956 *Year Book*.

The spelling and rules of punctuation followed in manuscripts shall be those found in the "Merriam-Webster New International Dictionary"; abbreviations and chemical formulas shall conform to *Chemical Abstracts*.

FIGURE AND GRAPHS—Figures and graphs should be black line drawings on white drawing paper. Photographic prints are acceptable, preferably glossy prints on double-weight paper. Duplicates should be available for dispatch to reviewers. In graphs the frame and actual curves should be inked more heavily than the co-ordinate lines, and these latter should not be too close together. Various styles of broken lines are sometimes desirable to distinguish curves. Experimental points should be given with small plane figures, such as circles, squares, diamonds or triangles. Numbers and legends on co-ordinate axes are to be lettered in the graph by the author. Numbers and titles of figures should be placed below the diagram or on the edge of the back. Each piece of illustration copy should bear on the margin or on the edge of the back the name of the author and the title of the paper.

SYNOPSIS—A separately written synopsis of not over 200 words containing the gist of the subject matter must accompany every manuscript.

GALLEY PROOFS—Galley proofs will be sent to the author by the publisher for correction before publication.

REPRINTS — Fifty reprints of papers published in the *Proceedings* will be furnished without charge by the publisher if requested when galley proofs are returned. These reprints are printed on one side of the sheet only and then stapled together. A schedule of prices of reprints in the usual form accompanies the galley proofs.

OWNERSHIP OF COPYRIGHTS AND PATENTS—All papers presented at general meetings of the Association or at meetings of any of its local sections and all communications shall become the property of the Association. Such papers are not to be published elsewhere until they have appeared in the *Proceedings* of the Association. Papers published in the *Proceedings* are copyrighted by the Association. Any patentable disclosures shall of course remain the property of the author or authors.

TRADEMARKS—As the AATCC wishes to co-operate in the protection of trademarks, it is requested that, in the body of the article, trademarks be written with an initial capital letter.

Inter Alia—Inter Nos

P J WOOD

COMEBACK

Edvard N Young, the celebrated consultant of Watertown, Conn, whom we have known well and favorably for many, many years, recently sent us a large clipping from a German paper bearing an advertisement of the Badische Anilin- & Soda Fabrik AG.

In it, the company modestly sets forth that they are located at Ludwigshafen on Rhine (as if anybody in the world didn't know they were there), just where they were when we spent a summer with them many, many years ago. One thing that stands out vividly in our memory is a sign on a long warehouse on the opposite bank of the Rhine, reading thus:

MANNHEIMER DAMPFSCHLEPPSCHIFFSFAHRTGESELLSCHAFT. We have an idea that they had to lengthen the warehouse to accommodate all this gigantic name. Mark Twain said, "Some German words are so long they have a perspective".

According to the sketch that accompanies the advertisement, it looks as if they had erected a "skyscraper" in the midst of the buildings that crowded the bank of the river at Ludwigshafen. In the text they refer to ""Das Hochhaus'', the high house, remarking that from it go threads to all parts of the world to the different branches of their sales organization which sold 1.5 billion D-marks worth of their chemical products last year.

Every working day, they say, they ship a million marks worth of goods and they are spending 5% of the amount of their sales in carrying on research, seeking for more products to make and to ship.

So rapid has been the increase in business that extensive additions to plant are necessary, necessitating a corresponding augmentation of capital funds. The capital of 510 million DM has been increased to 612 million DM.

Nothing stingy about the dividends, either; 7% in 1953, 8% in 1954, 9% in 1955, and 10% in 1956.

It looks to us as if they are doing "Pretty well, thank you".

WOOL OUTDATED?

We would say absolutely not. Especially after reading the "Story of Wool", a splendid and simply written booklet.

Scan these chapter titles—"Wool's History—from Cave to Skyscraper". "Wool Today—A Wonder of Nature, Perfected by Man". "The Wool Industry—From Fleece to Fabric".

The little discourse winds up with a short sermon on the benefit of looking for the WOOL LABEL, an outcome of the Wool Products Labeling Act, which was introduced and passed in 1939.

During the discussion on the properties of wool in the "Wool Today" chapter, it is shown that wool is warm in winter and cool in summer, which, on the face of it, looks absurd. But, just wait.

We once knew an Algerian in France, whose natural habitat was the "sands of the desert." He wore a turban and burnoose of the finest spun worsted imaginable. So, unless he was content to sweat all day in order to have the warmth of the wool for the chilly desert nights, the assumption is that this fiber gave him the utmost in comfort and provided protection from the African sun which shines almost every day, both summer and winter. He was an officer in a Spahi regiment and, presumably could not seek shelter, but had to swelter with his men.

Personally, we can testify that we prefer a so-called tropical worsted for comfort in summer from two points of view. It feels comfortable and it retains its smart appearance better than any other material we have ever tried. Only last summer, for instance, we arrived in Providence in a slight drizzle of rain. It occurred to us to take a taxi to get dry-shod to the Sheraton-Biltmore, just a hop, skip and a jump across the station square. Everybody else had the same idea, with

the result that, short of the employment of atrocious assault or mayhem, we saw that it was going to take a long time to get a cab. So out we strode into the inclement elements. On arrival at the hotel, our summer suit had been exposed to the shower, but half of the downfall had bounced off and in ten minutes, about the time it took to get toted up to our room, even the dampness was not perceptible.

This is what we like about wool. A good slogan for this sterling natural fiber would be "All Wool and No Bull."

ART IN BUSINESS

Probably nowhere in the realm of business is art applied to better advantage than in those annual calendars which fall on us like an avalanche, any time after the beginning of December.

Of course, not all of them would earn the plaudits of the highbrow art critic. In fact, some of them are nothing short of atrocious. Then, again, others are so lacking in taste that one would hesitate to hang them in one's office, wouldn't one?

So, when a masterpiece in the calendar field makes its appearance, it is something to talk about.

Sterling Price of MacFadden Brothers sent us such a masterpiece; as a matter of fact it is actually a series of masterpieces, one for each month and a constant joy all the year through they are too.

To take a couple of examples, the picture for January is the world-renowned "Quartetteabend bei Bettina von Arnim" painted by Johann Carl Arnold, the popular court and society painter of Berlin, who only died a comparatively short time ago, in 1916 to be exact. The picture shows something of the cultural life of that city and period, depicting an evening in the home of the poetess Bettina von Arnim where an instrumental quartette is entertaining the family and visitors. The artist has succeeded in capturing the cultural atmosphere of 100 years ago. The original of this splendid watercolor is in the Goethe Museum in Frankfurt am Main.

As the other example, let us take a look at the picture for May. This was painted by the celebrated animal painter, Jacques-Laurent Agasse, a Swiss born in Geneva in 1767 who went to Paris to study art under the Court painter of the Napoleon of that time. An English Peer, Lord Rivers, was interested in Jacques-Laurent and gave him commissions to paint his dogs. Eventually (1800) the Swiss artist emigrated to England where he attained high popularity as a "genre" painter. This picture is entitled "Flower Seller in London." It shows a flower peddler with his donkey and two-wheeled cart in a Dickensian-looking London street, resembling very much Half Moon Street, a romantic looking thoroughfare running from Curzon Street to Piccadilly, the trees in the background of the picture might well be those growing in Green Park, on the other side of Piccadilly. We lived in Half Moon Street for the better part of a week, a couple of years ago.

The very breath of Spring is in the air as the lady considers the purchase of a flowering potted plant. The original is in Winterthur, Switzerland.

We will take this opportunity of thanking Sterling Price for this very lovely calendar which was printed in Germany for the Farbenfabriken Bayer, the manufacturers of Perlon, which Mr Price's company distributes in this country.

TWO CENTURIES

Everyone knows the old bromide "the first hundred years are the hardest", but here is a company which has not only gone through the first hundred but which has successfully completed the second hundred.

J R Geigy was an old, old concern when this writer went to school with Clifford Roberts, whose father was the agent of Geigy in Leeds, Eng.

And nobody can sing "the old grey mare, etc" about this organization which goes on improving with the years, and looks good for 200 more.

Basel, the birthplace of Mr Geigy's enterprise, is one of those romantic-looking old Swiss towns that, once seen, is never forgotten.

Two things we remember about Basel. First, the market that is held in the town square is a busy, busy place; but when the clock strikes the closing hour, it melts away like a forgotten dream within minutes, with not so much as a scrap of wrapping paper or a vagrant piece of string to show that big business was carried on there minutes ago.

Many friends we remember from Geigy, USA, Dan Knowland one of the charter members of the NY Section, AATCC, Harry Spatz, Bob Allison, Bill Mahnken, "Shine" Mooradian and lots of others who have made life pleasanter for us and helped us with problems that come up from time to time.

Many happy returns, Geigy.—Q.E.F.

News of the Trade

FRL Licenses European Firm to Build Compactors

A Monforts, textile finishing machinery manufacturers with headquarters at M Gladbach, West Germany, have been granted exclusive rights to build and sell the FRL Compactor throughout the world with the exception of the United States, Canada, Japan, Russia, and the Eastern Block Countries.

FRL, developers of the Compactor which was invented by Richard R Walton, controls the licensing of the machines and the process in the woven, nonwoven and yarn fields. Since the initial announcement in 1955, twelve American and Canadian textile firms have been licensed to use the process. Machines for the United States and Canadian markets are manufactured by Riggs & Lombard, Inc, Lowell, Mass.

Developed primarily as a preshrinking machine, the Compactor reportedly has proved valuable also as a finishing machine independent of the preshrinkage aspect. As the fabric is compressed warp-wise by the Compactor (thus effecting preshrinkage), the fabric is allowed to expand in thickness and evidences marked improvements in bulk, loft, hand; and weave patterns are accentuated. By special settings, pattern effects can be achieved in flat fabrics, it is reported.

In addition to being a comparatively low-cost machine, the Compactor is said to be remarkably versatile. Both in actual production and in laboratory trial runs it has proved successful on most fabrics and yarns, regardless of their fiber content, according to Kenneth R Fox, FRL vice president. Machines have been built in the United States from 24- to 84-inch working widths, and with some modifications they can be built to even wider widths.

The machine and process are patented in seven countries and patents are pending in ten additional countries.

August Korte, engineer for A Monforts, and Joe C Roehl, engineering representative for Monforts in the United States, are presently studying the machine and the process at FRL, at Riggs & Lombard, and at several US mill installations, to get basic data preliminary to European manufacture.

Honored guests at the Chemical Club of New England, Inc's annual meeting, held April 28th at Boston's Sheraton-Plaza, were this year's recipients of the Club's five annual scholarships (l to r): Donald W Krech, Northeastern Univ; William Magee, Massachusetts Institute of Technology; John E Upham Jr, Hercules Powder Co, outgoing president of the CCNE; Irma E Coleman, Tufts Univ; John K Morris, American Cyanamid Co, chairman of the Scholarship Committee; Peter Groblicke, Brown Univ; and Frank Lind, Worcester Polytechnic Institute.

"Fibers and Civilization" Premiere

The world premiere showing of "Fibers and Civilization," a film on the dramatic history of natural and chemical textile fiber development, was presented last month by the Chemstrand Corporation for officials of the US State Department and the American and European press at the Brussels World's Fair.

The film is a part of the US program to acquaint Fair visitors with "How America Lives." Chemstrand is among a number of American industries participating in the Fair program. The firm also has provided American college students who are serving as official guides with uniforms of Acrilan, its acrylic fiber product.

The film will be made available for the public and educational use after advance showings in Belgium, England and throughout the rest of Europe, according to R H Brigham Jr, director of public relations for Chemstrand.

"This film traces the origin of the natural fibers dating back to ancient times," Brigham said. "But it also relates how man's great advances in technological and scientific research have brought about the creation of chemical textile fibers—fibers that nature never dreamed of." The "Fibers and Civilization" film covers the entire textile fiber industry and the company's aim was to present a complete and objective film document.

Solvay to Modernize Mutual Facilities at Baltimore

A major modernization and improved materials-handling equipment project is about to begin at the Baltimore Mutual Chromium Chemicals plant of Solvay Process Division, Allied Chemical Corp. The project will include alteration of an existing building to a modern warehouse facility for more efficient storage and handling of chromium products; construction of a new truck dock; and installation of new, completely automatic materials-handling equipment and a modern ventilation system.

Products manufactured at the Baltimore plant include the Mutual line of sodium bichromate, sodium chromate, potassium bichromate, potassium chromate, ammonium bichromate, chromic acid, and Koreon chromic sulfate.

Emery Relocates NY Sales Office

The New York sales office of Emery Industries, Inc, was moved to new quarters at 1 Exchange Place, Jersey City 2, NJ, on May 1.

The new office now serves as headquarters for Harry D Armitage, Robert J Roberts and Robert C DeLollis, fatty acid sales representatives, and George R Williams and Robert S Haley, organic chemical sales representatives.

The office handles Emery Industries' full line of chemical products.

Stevensons (USA) Relocates NY Office

Stevensons (USA) Inc has completed the move of its sales office from 110 East 42nd St to Suite 1702, 21 East 40th St, New York, NY. The firm, a recently established affiliate of Stevensons (Dyers) Ltd, Ambergate, England, has initiated several wool shrinkage control processes in the United States and Canada. They are currently being licensed to about 30 manufacturers of tops, yarns, woven fabrics and knitted goods to be sold under the trademark Dylanize.

M C Stevenson has taken over the management of sales and promotional policies for Stevensons (USA) Inc, replacing M Stanley Brown who passed away recently. Mr Stevenson is president of the corporation and director in charge of the patent licensing division of Stevensons (Dyers) Ltd. He announced that an expanded promotional and educational campaign is currently being released through trade and consumer magazines . . . about 413 ad insertions will be placed between now and January 1. He further stated that the new processes being licensed can be applied as part of the normal methods of dyeing or processing raw stock, top, yarn or piece goods.

The Stevensons testing laboratory is located in North Providence, RI under the management of Frank Murphy.

Roger J Gentilhomme, formerly with Cluett, Peabody and Co as assistant manager of market development in the Sanforize Division, has joined Stevensons (USA) as a sales and technical executive contacting industrial, manufacturing and retail markets with respect to licensee agreements on the Dylanize trademark.

Schedule for AOCS Short Course Completed

Program information on the 1958 short course, to be held July 14-18 at the Princeton Inn, Princeton, NJ, by the American Oil Chemists' Society, indicates that Vincent C Meunier of Rohm and Haas Co, Philadelphia, will speak on "Fatty Alcohols" on Monday, thus completing the schedule.

A change in a Thursday paper has also announced. "Recent Advances in the Analysis of Syndets and Soaps" by S Siggia of General Aniline and Film Corporation, Easton, Pa, will be substituted for "Analytical Application Stressing the Newer Methods" by E W Blank and R M Kelley of the Colgate-Palmolive Co, Jersey City.

Morningstar-Paisley to Expand Latex Facilities

Morningstar - Paisley, Inc, New York, is planning an expansion of its latex and plastisol sales and technical departments. The company entered this field in October 1957 when they purchased the Federal Latex Corp and Federal Chemcal Corp of Brooklyn, NY. Samuel Tisser, who headed this operation for Federal, continues as manager of the department for Morningstar-Paisley.

The first stage of the program has started with an expansion of the latex and plastisol sales and laboratory facilities, plus additional pilot plant equipment at the New York, NY, location, to be followed by installation of large processing equipment with modern quality control devices at Clifton, NJ, adjoining the firm's Haberland plant. Completion of new facilities expected by August, 1958.

The latex compounds will be sold under two trade name designations, Morpalex, a prevulcanized system, and Morpatex, a line of textile latex coating compounds for the upholstery, rug and carpet industry. A Morpatex formula may be used in bonding scrap foam rubbers and synthetic foam fragments into useful molded states for cushioning and packaging purposes.

PTI Alumni Weekend

The Annual "Back To The Campus" weekend of the Alumni Association of the Philadelphia Textile Institute, will be held June 5-7 on the campus and at the Manufacturers Country Club, Oreland, Pa.

Festivities for the weekend will begin Thursday, June 5th, highlighted by a softball game between the alumni and the currrent graduating class at the Institute. A clambake will follow with customary refreshments and the evening will be drawn to a close with the annual alumni meeting.

Friday, June 6th, the annual golf tournament will be held at the Manufacturers Country Club. In addition, returning alumni will be able to take part in a married men versus single men softball game, contests in darts, quoits, cards, swimming, tennis, and putting on the green. At 7:00 PM there will be a banquet in the country club dining room and prizes for the winners of the various activities will be awarded.

On Saturday, June 7th, the alumni will attend the 74th Commencement Exercises on the campus.

Reservations for the outing can be made by contacting the alumni office of the Philadelphia Textile Institute.

First Jobber Offering Fabric Treated with Scotchgard

First jobber to offer a wide variety of upholstery fabrics treated with Scotchgard brand stain-repeller was announced recently by Minnesota Mining and Manufacturing Co (3M), St Paul, Minn, maker of the finish.

National Fabrics, distributed by National Upholstery Supply Co, Inc, Minneapolis, Minn, are now available in 21 patterns treated with the stain-repeller. These include cotton prints, damasks, nylons, and what are probably the first nylon friezes in the country to be protected by the finish, 3M said.

Price of the fabrics, which will be sold to decorators, upholsterers, and department stores through some 6,000 outlets in the United States, is from $4 to $18 a yard, according to Harry Hartstein, president of National.

"Buy in USA" Promotion

Stowe-Woodward, Inc, is offering colorful stickers, which say "Whatever you buy in textiles 'made in U.S.A.' gives you quality you can trust", as a service to the industry. Small quantities of the promotion stickers will be provided by the firm free of charge, and large quantities for commercial use will be provided at cost to help promote American textiles.

Sample stickers and quantity prices can be secured from Stowe-Woodward, Inc, P O Box 851, Griffin, Ga, or the firm's Newton Upper Falls, Mass, plant.

Rockford Textile Mills Sign as Fabulized Licensee

Fabulized, Inc, Philadelphia, Pa, has announced that Rockford Textile Mills, Inc, McMinnville, Tenn, has signed a Fabulized licensing agreement.

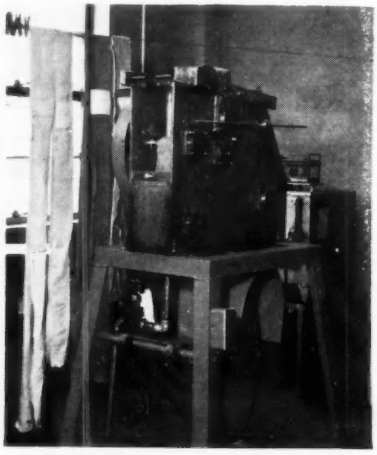
Lynwood Smith, president of Rockford, reports that his company plans immediate application of Fabulized, a new finish designed to make synthetic fabrics absorbent.

Hummel Offering Sodium Perborate

Hummel Chemical Co, 90 West Street, New York 6, NY, is now offering sodium perborate, tetrahydrate, technical and NF in both fine and coarse powders.

Technical data, samples and further information are available on request.

• NEW PRODUCTS AND DEVELOPMENTS •



SRI Laboratory Fulling Machine

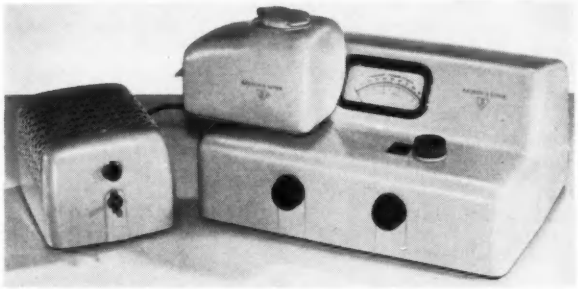
Laboratory Fulling Machine

A laboratory wool fulling machine has been constructed by Southern Research Institute, Birmingham 5, Ala, for the purpose of evaluating chemicals used for wool fulling or felting. This machine is a modification of a laboratory wool fulling machine known in the textile field as the "La-Fleur Machine." The SRI machine reportedly allows more flexibility in operation and more accurate control of pressures and speeds of the rolls. It may be used to scour and bleach cotton and synthetics as well as wool. Transparent plastic top and doors on the ends of the machine permit visual inspection of the operations being performed.

It is stated that the machine has been successfully used in developing new wool fulling and felting formulations, as well as for evaluating the effectiveness of scouring and bleaching chemicals. It has also been used to compare the effectiveness of a homologus series of surfactants to determine the relationship between chemical composition and effectiveness in fulling or felting of wool and other animal fibers.

B & L Spectronic Color Analyzer

A new color analysis instrument which reportedly permits extremely accurate readings in percent reflectance of textiles, dyes, and a variety of other products has been announced by the Bausch & Lomb Optical Co, Rochester, NY. It is claimed that the new instrument, consisting of a Spectronic "20" Spectrophotometer and a reflectance attachment, provides the easiest operation and lowest cost of any color analysis instrument.



B & L Spectronic "20" Spectrophotometer and new Spectronic Color-Analyzer

The design of the B&L Spectronic Color Analyzer allows examination of various-size samples. The instrument projects a spot of light which permits color analysis of extremely small samples. In order to handle large-size samples, the measuring aperture cover is designed to swing out of the way, and room is provided for operating the shutter.

A trichromatic chart permits conversion of the reflectance readings to standard CIE trichromatic values. Readings of liquid or powdered samples can be obtained by use of a glass cell and light shield.

The Spectronic Color Analyzer contains a true spherical integrator, which is said to assure highest accuracy in most applications of color analysis and color matching. The measuring reflectance system is designed so that fading, chipping or staining of the interior surface of the sphere will not affect the accuracy of readings. The instrument reportedly eliminates the need for glass filters, by substituting a diffraction grating, which provides light of high spectral purity.

A positive voltage regulation is provided by a developed power supply, which reportedly will operate without fluctuation on 50 or 60 cycles.

The B&L Spectronic Color Analyzer reportedly requires a warm-up period of only five minutes, is accurate enough for lab use, durable enough for production use, yet light, compact, and portable. Bausch & Lomb sells a colorimeter, a spectrophotometer and the color analyzer complete for $515. For present owners of the Spectronic "20", the color analyzer attachment is $280.

Alcogum WS-25

Alco Oil & Chemical Corp has announced the development and commercial availability of a new warp size adjuvant, Alcogum WS-25. The new material is the sodium salt of a polymerized acrylic acid resin.

Mills using it report equal or improved weaving efficiency at up to 30% savings in size cost, it is claimed.

Alcogum WS-25 is said to be especially effective with spun warps made of synthetic fibers. It reportedly goes into solution readily and has low enough viscosity to pour from a faucet, which makes for easy handling in process. It is also said to be water-soluble and readily removable from sized fabrics.

Alco cites the following typical properties for Alcogum WS-25:

Total solids—25%	Color—light amber
Weight per gallon —9½ lb	Odor—odorless to slightly ammoniacal
pH—10	
Viscosity—25 poises	Clarity—clear to hazy

Samples and technical information are available from Alco Oil & Chemical Corp, Trenton Ave & William St, Philadelphia 34, Pa.

Curite LTC

Proctor Chemical Co, Salisbury, NC, has announced the release of a silicone catalyst specifically designed for use with silicone emulsions, offered under the tradename Curite LTC, for use where high curing temperatures are undesirable. It is described by the manufacturer as a catalyst that performs satisfactorily at curing temperatures of 250°F and enables the user to apply silicones to fabrics where high curing temperatures cause dye sublimation or discoloration.

• NAMES IN THE NEWS •

Joerger

The appointment of **Robert W Joerger** as chief chemist of Franklin Process Co, Div of Indian Head Mills, Inc, at Greenville, SC, was announced last month by B S Phetteplace, manager.

Mr Joerger joined the company in 1942 and until recently was employed at the Providence, RI, plant.

Walter J Hamburger, director of Fabric Research Laboratories, Inc, Dedham, Mass, has been elected a vice president of The Textile Institute (Manchester, England). He is the first American to hold office in the Institute.

The Textile Institute, founded in 1910 and granted the Royal Charter in 1925, has its greatest membership in Great Britain but includes an important overseas membership. Dr Hamburger was an original member of the United States Panel of the Institute, the first panel to be established outside of the United Kingdom.

Dr Hamburger, 1956 Olney Medal Award winner, has been director of FRL since he and two associates founded the organization in 1942.

Heyden Newport Chemical Corp has named **Herman Sokol** executive vice president.

Dr Sokol has been vice president in charge of all Heyden research and development since 1954 and, since the Newport combination has been responsible for coordination and integration of research facilities and activities, for all divisions of Heyden Newport.

He joined Heyden as a research chemist in 1943. He has been a director since 1955.

Nopco Chemical Co, Harrison, NJ, has announced the election of Vice President **Harold A Swanson** to its board of directors. Mr Swanson, who is in charge of sales and laboratories of the company's Industrial and Fine Chemical Divisions, has been with Nopco 21 years.

The New York Chapter of The American Institute of Chemists will award its 1958 Honor Scroll to **Karl M Herstein**, president of Herstein Laboratories, Inc, of New York. The award will be made at the annual dinner meeting on June 4, 1958 at 6 pm, in Mitzi's Jager House, 1253 Lexington Avenue near 85th Street, New York, NY.

The honor is being conferred upon Mr Herstein because of his long record of devoted service to the Institute, to the American Chemical Society, and to the wefare of chemists in the United States.

Waller

Anhorn

Gehman

Young

Promotions of four men in the Research division of The Goodyear Tire & Rubber Company have been announced. Those named to new posts were **R C Waller**, manager, plastics research; **V J Anhorn**, manager, organic chemicals processing; **S D Gehman**, manager, physics research, and **F J Young**, manager, process engineering.

Waller and Anhorn will report to **A M Clifford**, manager of chemicals and plastic research, while Gehman and Young will report to **W H Nicol**, manager, physics and engineering research.

Alexander Pennucci has been elected vice president of the Chemical Manufacturing Co, Inc, Ashland, Mass.

Frank A Salina succeeds Mr Pennucci as chief chemist.

Crenshaw

Ulysses C Crenshaw has been added to the sales staff of The Harry Miller Corp, Philadelphia manufacturers of industrial chemicals, oils and greases.

Mr Crenshaw will handle the company's line of textile and other specialty chemicals throughout North Carolina and southern parts of Virginia from headquarters in Spartanburg, SC.

Mr Crenshaw formerly was technical superintendent, quality control, of the Lockhart (SC) plant of Monarch Mills.

F J Knight, vice president, Hubbard Felt Co Ltd, Montreal, received the fourth Bronze Medal of the Canadian Association of Textile Colourists and Chemists, Quebec Section, at the Association's 22nd Annual Dinner held last month at the Sheraton-Mt Royal Hotel, Montreal.

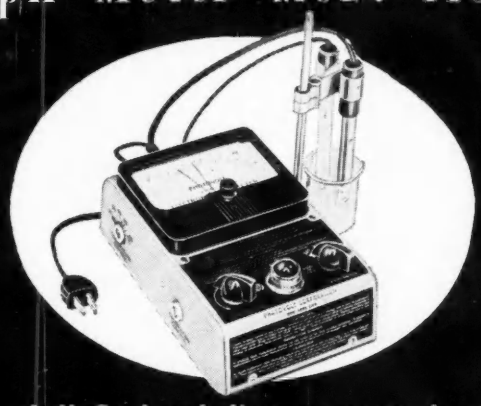
Mr Knight has represented the Quebec Section at the Textile Technical Federation of Canada for ten years, was elected five times as a director of the TTFC, and three times as general chairman of their biennial Textile Seminars. He served as technical papers chairman of the recently concluded Canadian Textile Conference.

The presentation—for "outstanding and continued devoted service"—was made by **L J Sheps**, vice-president, Trilon Chemicals Ltd, Lachine, Que.

Re-elected to executive positions with the Association were President **C E Coke**, Courtaulds (Canada) Ltd; Vice presidents **S H Chambers**, Montreal Cottons Ltd, and **J Dean**, Canadian Celanese Ltd, Secretary **J H Lowe**, Consolidated Dyestuffs and Chemicals Ltd.; and Treasurer **A Greyborn**, Bruck Mills Ltd.

The new council is comprised of **D Heggie**, Ayres Ltd; **J G Soroka**, Fabric Dyers Ltd; **C R Teichgraber**, Domil Ltd; **C F Fitton**, Sandoz (Canada) Ltd; **L Languedoc**, Associated Textiles of Canada Ltd; and **R McArthur**, Chateau Dyers Ltd.

PHOTOVOLT
pH Meter MOD. 115



A full-fledged line-operated pH Meter of remarkable accuracy at the unprecedented price of **$130.-** (complete incl. electrodes)

Write for bulletin #225 to

PHOTOVOLT CORP.
95 MADISON AVE. NEW YORK 16, N. Y.

ARE YOU TIED UP IN NETS?

Tied up with a dyeing problem? ● Fablok Versadye® Nets solve that problem . . . give you complete dye-bath penetration without absorbing . . . whether you're dyeing sweaters or knitted fabrics of Orlon, Dacron, Nylon, Acrilan or Banlon. ● Fablok knits superior synthetic Nets to the exact specifications you require (from yarn to finished product).

Send us your inquiry in full detail. We'll "tailor" the Net to fit your need.

Fablok MILLS, INC.
INDUSTRIAL NET DIVISION
46 Cordier St., Irvington, N. J.

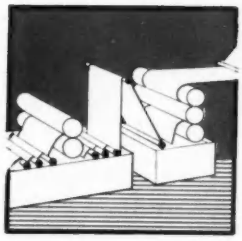
TC TENNESSEE CORPORATION

LIQUID SULFUR DIOXIDE
HIGHEST QUALITY
SO_2

For Effective Removal of
RESIDUAL CHLORINE

Tennessee's Liquid Sulfur Dioxide Is a Most Efficient and Economical Antichlor

SO_2 accomplishes the following—Acidifies alkaline hypochlorite making it easier to wash out. Reduces chlorine to the harmless valence minus one (CI-I)! Leaves fabric acid free.



Available In:
- **CYLINDERS**
- **TON DRUMS**
- **TANK TRUCKS**
- **TANK CARS**

Tennessee's Liquid Sulfur Dioxide is also very effective as a reducing, bleaching and neutralizing agent, and pH control.

We would like to consult with you on the possibilities of Tennessee's Liquid Sulfur Dioxide in your processing.

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

First
from BALTIMORE

The First SUBMARINE of practical value was the "ARGONAUT", invented by SIMON LAKE and built by the Columbia Iron and Dry Dock Co., of BALTIMORE in 1897.

Courtesy – The Baltimore News-Post

– also from Baltimore...

YOUR *First* CHOICE IN BLACKS

- DIRECT
- ACID
- DEVELOPED
- ACETATE
- FORMALDEHYDE
- LOGWOOD

THE HOUSE OF BLACKS

Consult your local dyestuff distributors for information and samples. Shipments can be made from our Baltimore factory.

YOUNG ANILINE WORKS, INC.

OFFICE AND FACTORY: 2701-2733 BOSTON STREET • BALTIMORE 24, MARYLAND

Proven in the dye house–

Improved Scouring with UNISHADE

The original one dye-bath agent for scouring and levelling hosiery.

Write for details.
Our technical staff is at your service.

CHEMISTS FOR INDUSTRY

KALI MANUFACTURING CO.

427 MOYER ST., PHILA. 25, PA.

W B Mason

Spears

Hewson

William B Mason has been appointed general sales manager of Intex Chemical Corporation, Lodi, NJ.

Promoted to his new position from the post of Western sales manager, Mr Mason first joined Intex in June, 1957. He will make his headquarters at the Company's general offices in Lodi.

Prior to his joining Intex, Mr Mason served as Mid-western district sales manager for Onyx Oil & Chemical Co, and had over ten years of experience in the field of surface-active agents.

Herbert W Mason Jr, has returned to Reichhold Chemicals, Inc, as administrative vice president following a one-year's leave of absence.

Mr Mason, who first joined RCI in 1936, served in the firm's Technical Service, Traffic and Production Departments. He was made vice president in charge of purchasing about ten years ago after organizing the Purchasing Department.

Phi Psi, professional textile fraternity, honored five prominent textile men with Honorary Membership at its 55th Annual Convention, held last month in Philadelphia, Pa: **Victor B Holland,** technical director of research and laboratories, Cannon Mills Co; **Lloyd O Koons,** president, Scholler Bros, Inc; **George E Linton,** dean, Textile Dept, Fashion Institute of Technology; **Ernest E Rettberg, Jr,** vice president, Scholler Bros, Inc; and **Prentice M Thomas,** editor and publisher, *Textile World.*

The awards were made by **George F Long,** Harchem Div, Wallace & Tiernan, Inc, Grand Council President of Phi Psi.

Peter Floud. keeper, Dept of Circulation, Victoria and Albert Museum, London, England, delivered a lecture on the subject "English Polychrome Chintzes: A Survey of New Knowledge" before an enthusiastic audience on April 10th at The Cooper Union Museum, New York.

Alex W Spears Jr has been named new sales and service representative for Mount Hope Machinery Co in Alabama, Western Tennessee, Louisiana, Mississippi, Arkansas, Texas and Oklahoma. Mr Spears' headquarters will be Mobile, Alabama. The company manufactures a complete line of web-handling equipment.

Four members of Du Pont's Organic Chemicals Research Division have been promoted to the position of senior research chemist: **Clarence Belcher, Louis Spiegler,** and **Viktor Weinmayr** of Du Pont's Jackson Laboratory, Deepwater Point, NJ, and **Frederic Stilmar** of the Organic Chemicals Research Laboratory at the Experimental Station, Wilmington, Del. These are the first appointments to the position of senior research chemist made by the Organic Chemicals Department.

Mr Belcher, who has been with Du Pont since 1930, has been largely responsible for the development and successful operation of manufacturing processes for over 30 dyes involving wool colors, vat colors, and colors for synthetic fibers. He has contributed significantly to the commercialization of new dyes for Orlon acrylic fiber and Dacron polyester fiber.

Mr Spiegler, who has been at the Jackson Laboratory since 1935, is an expert in process development of aromatic intermediates and has made outstanding contributions in catalytic hydrogenations.

Mr Stilmar, with Du Pont since 1937 has originated three important red vat dyes and has been responsible for other advances in the dye field.

Dr Weinmayr, a specialist in exploratory research on complex organic compounds, has been with Du Pont since 1930.

* * *

W Samuel Carpenter 3rd, director of sales of Du Pont's Petroleum Chemicals Division, became assistant general manager of the company's Electrochemicals Department May 1, succeeding **Charles B McCoy,** who has been named general manager of the Elastomer Chemicals Department.

John E Hewson has been appointed manager of the New York sales region of The Foxboro Company, Foxboro, Mass, supervising instrument sales activities in the area including New York City and sections of Connecticut and New Jersey.

Mr Hewson succeeds **E H Huckman,** who recently assumed the position of assistant field sales manager for the industrial instrument firm. Mr Hewson joined The Foxboro Company in 1949 as an instrument engineer in the Dallas, Texas branch, and was later appointed branch manager of the company's Tulsa, Oklahoma office.

Replacing Mr Hewson as manager of the Tulsa branch is **D T McElligott,** a Foxboro field engineer at Dallas and El Paso since 1953.

Instrument users in the El Paso area will now be served by **J M Flanigan Jr,** formerly of the Foxboro, Dallas branch.

Ernest H Allard has joined the Southern Research Institute staff in Birmingham, Ala, as senior textile chemist.

Mr Allard was formerly chemist for Merrimac Hat Corp and Textron, Inc, Sanforlan technical service representative, and superintendent of Sanforset Technical Services; he also did project work for the Sanforized Division of Cluett, Peabody and Co, Inc, for a number of years.

John A Meagher has been named assistant to the manager of labor relations of General Aniline & Film Corp.

Mr Meagher was formerly in the Personnel Department of the National Aniline Division of Allied Chemical and Dye Corporation.

William M Ritchie, a senior in the School of Textiles at North Carolina State College, has been awarded the Keever Starch Company Scholarship for the current college year.

The $400 scholarship is provided by Keever Starch Co, Columbus, O, and is awarded annually to an outstanding senior in textiles at N C State.

Townsend

Horace Townsend Jr has been appointed professor of management and marketing and head of the department at Philadelphia Textile Institute.

Since 1937, he has been on the faculty of eight colleges and universities.

His prime concern at PTI will be the development of the Management and Marketing degree program with emphasis on the Business Administration courses.

New assignments for a number of key technical personnel of the Baltimore plant (Mutual Chromium Chemicals), Solvay Process Division, Allied Chemical Corp have been announced. Since Mutual Chemical became associated with Solvay Process last year, there has been a consolidation of research, engineering, and technical service departments. The new assignments involve transfer of personnel concerned to Solvay's research center at Syracuse, N Y.

Winslow H Hartford has been named research supervisor; **William H Weed** becomes principal engineer; and **George E Best** joins the technical service department as technical advisor to the general manager.

Other appointments include **Edward C Bertucio** and **Robert D Byers** to technical service; **Benedict F Smith** and **Keith A Lane** to the research staff; and **Donald W Horgan, Craton D Pitner,** and **John M Price** to the engineering section.

Milton A Glaser, vice president and technical director, Midland Industrial Finishes Co, Waukegan, Ill, discussed "Modern Organic Finishes" at the Midland Coatings Society's fourth meeting of the current season. The dinner meeting held May 13 at the Midland Country Club, Midland, Mich, was open to nonmembers.

Mr Glaser spoke on the newer types of film-forming materials, such as the silicones, epoxies, urethanes, and their applications. He briefly reviewed the field of organic coatings.

Blake

A D Blake, sales engineer for the spectrochemical equipment line manufactured by Baird-Atomic, Inc, Cambridge, Mass, has been assigned to handle the Chicago area.

Blake has been working in the home office on special project applications. He was formerly employed as a quality control engineer with General Electric Co, and Ford Motor Company.

Richard Neuer has joined Stein Hall & Co, Inc as a sales representative in the Company's New York Branch Sales Office. He will be concerned with the sale of the company's line of starch products.

Mr Neuer was a salesman for Geismar & Co, Inc, starch importers, for the past three years. Prior to that he was with the firm of E Miltenberg, New York.

OBITUARY

ALBERT R JENNY

ALBERT R JENNY, 49, sales manager, Jersey State Chemical Co, Haledon, NJ, died April 25th. He was responsible for national sales, sales promotion, and distribution for the last year. He was formerly associated with the Onyx Oil & Chemical Co in a similar capacity.

At the time of his passing, Mr Jenny was supervising the company's expansion into the paint field from its previous concentration on supplying textile dyers and finishers.

A native of Paterson, NJ, Mr Jenny had made his home in nearby Glen Rock since 1942.

Pending the announcement of a successor, Thomas Granatell will manage Mr Jenny's departments.

HAROLD E SMITH

HAROLD E SMITH, chairman of the board, The Wallerstein Co, Inc, New York, NY, died suddenly on April 5th at his home in Madison, NJ.

Mr Smith was associated with the Wallerstein Company for almost thirty years, having joined the company as general manager of its Staten Island plant on July 1, 1928. In 1944, he was elected vice president in charge of production. Five years later he became executive vice president of the company. Following the death of Leo Wallerstein, Mr Smith was elected president of the Wallerstein Company in 1955. In 1958, Mr Smith retired from this post to become chairman of the board. He was succeeded as president by Arthur C Emelin.

In announcing Mr Smith's death, Mr Emelin expressed the appreciation of the entire organization for the constructive service rendered to the company by Mr Smith over a period of almost three decades and his personal sorrow and that of the entire Wallerstein staff at losing a close and valued associate.

Wheeler

Crest Chemical Corp, Newark, NJ, has appointed **Lawson Wheeler** as its sales manager for New England.

Mr Wheeler, who has had nearly 10 years practical experience as a dyer and finisher, will concentrate on sales and service of the company's textile specialties in the New England area.

Appointment of **Earl F Miller** as manager of The General Tire & Rubber Company's Ashtabula, O, chemical plant has been announced. The former plant manager, **P J Wallace,** has been named production manager of the company's new synthetic rubber plant at Odessa, Texas.

William Bryan Davis has been made head of the local Purchasing Department of The Carlisle Finishing Co at Carlisle, SC.

Purchasing will be under the overall supervision of **Fletcher Jordan Jr,** who is responsible for the purchasing activities of both Union Bleachery and Carlisle Finishing Company, a division of Cone Mills Corp.

Mr Davis has been head of the Supply Department at Carlisle Finishing Company since the plant began operations.

Officers elected by The Chemical Club of New England, Inc for the coming year are as follows:

President—**Irving G Loxley,** Heyden Newport Chemical Corp

Vice president — **Seth U Shorey,** Monsanto Chemical Co

Treasurer—**T Fred Baker Jr,** Fritzsche Bros Inc

Secretary—**Loring P Litchfield,** E I duPont de Nemours & Co, Inc.

On June 22, the American Institute of Chemical Engineers will honor **Frederic Dannerth,** industrial research chemist and chemical engineer, as a charter member with a medal.

Dr Dannerth and the late Louis A Olney, two representatives of the textile industry, were present when the Institute was founded in Philadelphia on June 22, 1908.